US Army Corps
of Engineers
St. Paul District

SUPPLEMENT NO. 1 TO DESIGN MEMORANDUM NO. 2 AND ENVIRONMENTAL ASSESSMENT FLOOD CONTROL PROJECT

SOUTH FORK ZUMBRO RIVER STAGE 1B

ROCHESTER, MINNESOTA

NOVEMBER 1988

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6. AUTHOR(S)

5d. PROJECT NUMBER

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190 5th St. E.
St. Paul, MN 55101

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Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

Supplement 1 issued as a separate volume.

14. ABSTRACT

This supplement to the design memorandum for Stage 1B of the Rochester Flood Control Project investigates aesthetic and recreational concerns and environmental issues not addressed in the environmental impact statement, which includes impacts caused by a proposed drawdown of Silver Lake and the discovery of contaminated waste.

15. SUBJECT TERMS

Flood control
Rochester, Minnesota
Zumbro River
Environmental assessment

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(Include area code)*
Unclassified	Unclassified	Unclassified			

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SOUTH FORK ZUMBRO RIVER AT
ROCHESTER, MINNESOTA

SUPPLEMENT TO
DESIGN MEMORANDUM NO. 2
STAGE 1B

PURPOSE

1. Stage 1B of the Rochester flood control project consists of channel modifications to the South Fork Zumbro River and a portion of Bear Creek and modifications to Silver Lake Dam. The DM (design memorandum) for Stage 1B was prepared in February 1987. This supplement was prepared to investigate the local sponsor's aesthetic and recreational concerns that were not addressed in the DM, to present an investigation of environmental issues that were not addressed in the EIS (environmental impact statement), and to address 1st endorsement comments.

DEPARTURES FROM DM. NO. 2

2. Changes since completion of DM No. 2 are as follows:

a. Plate 1 was revised to provide an updated drawing schedule.

b. Plates 12 through 15 showing typical sections were revised.

c. Plates 16 through 23 showing plan and profile views were revised.

d. Plate 36 showing electrical details for Silver Lake Dam was revised.

e. Plates 42 and 43 showing the left and right bank floodwalls were revised.

f. Plate 45 showing the bicycle/pedestrian trail was revised.

g. Plates 46 through 51 were added to provide details on aesthetic/recreational features.

h. Supplements were prepared for Appendixes A (Hydraulic Design), B (Geotechnical Design), and G (Correspondence).

i. Plates B-7, B-8, and B-50 were revised.

j. Appendixes C (Structural Analysis and Design), D (Detailed Cost Estimate), E (Constructibility), and F (Recreation, Landscape Development and Aesthetic Considerations) were entirely revised.

k. Structural computations on the floodwalls, bicycle/pedestrian trail, and pedestrian bridge were added.

DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

FLOOD/RETAINING WALLS

3. The channel slope protection has been changed from riprap to flood/retaining walls on the right bank between stations 165+15 and 169+05, 169+40 and 174+79, 177+50 and 183+67, and 187+45 and 193+45 and on the left bank between stations 186+20 and 202+90.

BICYCLE PATH AND UNDERPASSES

4. A bicycle/pedestrian trail will be constructed on the right bank between Seventh Street Northeast and Fourth Street Southeast and from Fourth Street Southeast to Third Avenue Southeast. A trail will be constructed on the left bank from Second Street Northeast to Mayo Memorial Park. Trail underpasses and approaches will be constructed at Seventh Street Northeast, Center Street, and Third Avenue Southeast.

BICYCLE/PEDESTRIAN BRIDGE

5. A bicycle/pedestrian bridge will be constructed at station 194+00.

ENVIRONMENTAL ANALYSIS

6. The DM studies identified several environmental impacts that were not addressed in either the final EIS or the Supplemental Information Report. These impacts are caused by a proposed drawdown of Silver Lake during construction and by the discovery of contaminated waste between stations 174+30 and 176+00. An environmental assessment has been prepared as part of this supplement to address these impacts.

RECREATION, LANDSCAPE DEVELOPMENT, AND AESTHETIC CONSIDERATIONS

7. In a 23 January 1987 letter, the local sponsor expressed concern over the proposed DM design for Stage 1B. These concerns were addressed during the preparation of this supplement through extensive coordination with the local sponsor.

8. The design of recreational features was refined from the design presented in the DM to include a pedestrian trail on the left bank in Mayo Memorial Park, a pedestrian bridge, and four river accesses.

9. Aesthetic concerns over the use of riprap channel protection in the Mayo Memorial Park area were addressed by replacing a portion of the riprap slope protection with concrete flood/retaining walls on the right bank between stations 165+15 and 169+05, 177+50 and 183+67, and 187+45 and 193+45 and on

the left bank between stations 186+20 and 202+90. The recreation trails have been incorporated into the design of the bank protection.

10. A detailed discussion of the recreation and aesthetic design is presented in appendix F. Copies of pertinent correspondence with the local sponsor are in appendix G.

REAL ESTATE REQUIREMENTS

11. Right-of-way requirements have not changed since completion of the DM.

COST ESTIMATE

12. The cost estimate for Stage 1B has been revised to reflect the design changes presented in this supplement. The detailed estimate is in appendix D.

13. Cost sharing for Stage 1B was determined on the basis of the 1986 Water Resources Development Act. The non-Federal costs for flood control features were computed as 25 percent of the total flood control feature costs. The non-Federal share of the recreation costs was computed as 50 percent of the total recreation costs. In addition to these costs, the cost increase caused by replacing the riprap slope protection in Mayo Memorial Park with flood/retaining walls was determined to be a betterment cost. This cost, less an aesthetic cost allowance described in the 29 October 1987 letter from CENCS to the local sponsor, is entirely the local sponsor's responsibility and is not included as part of the project costs.

14. A summary of the estimated total project and non-Federal first costs is in appendix D.

15. The difference in total project first costs ($3,054,710) between this supplement estimate ($15,262,890) and that presented in the DM ($12,208,180) is attributed to the following:

a.	Relocations: The increase in cost is due to price level increases.	+ $ 10,590
b.	Channels: The increase in cost is due to refinement of the channel slope protection design to incorporate aesthetic improvements requested by the city of Rochester (+$118,230) and price level increases (+$555,520).	+ $ 673,750
c.	Recreation: The increase is due to the refinement of the trail and underpass design and to inclusion of river accesses (+$871,300) and price level increases (+$74,430). This increase includes both the Federal and non-Federal cost increase.	+ $ 945,730

d. Engineering and Design: This increase is based on the A-E contract and contract administration costs and price level increases. + $1,101,190

e. Supervision and Administration: The increase is based on increases in the construction and engineering and design costs. + $ 146,940

f. Lands and Damages: The cost of real estate has been reevaluated on the basis of acquisitions to date. + $ 167,000

g. Non-Federal relocations: Costs of non-Federal relocations were decreased (-$10,790) as a result of refined engineering and design and increased (+$20,300) as a result of increased price levels. + $ 9,510

DRAWING SCHEDULE

DRAWING NO.	SHT.	TITLE
M30-R-10/ 1	1	GENERAL PLAN & DRAWING SCHEDULE
M30-R-11/ 1	2	RIGHT-OF-WAY STA. 126+00 TO STA. 136+00
M30-R-11/ 2	3	RIGHT-OF-WAY STA. 136+00 TO STA. 148+00
M30-R-11/ 3	4	RIGHT-OF-WAY STA. 148+00 TO STA. 160+00
M30-R-11/ 4	5	RIGHT-OF-WAY STA. 160+00 TO STA. 171+50
M30-R-11/ 5	6	RIGHT-OF-WAY STA. 171+50 TO STA. 183+50
M30-R-11/ 6	7	RIGHT-OF-WAY STA. 183+50 TO STA. 194+00
M30-R-11/ 7	8	RIGHT-OF-WAY STA. 194+00 TO STA. 205+67
M30-R-11/ 8	9	RIGHT-OF-WAY STA. 0+00 TO STA. 6+55
M30-R-11/ 9	10	RIGHT-OF-WAY DATA SETS
M30-R-11/10	11	RIGHT-OF-WAY DATA SETS
M30-R-64/ 1	12	TYPICAL SECTION STA. 126+90 TO STA. 168+40
M30-R-64/ 2	13	TYPICAL SECTION STA. 168+40 TO STA. 182+60
M30-R-64/ 3	14	TYPICAL SECTION STA. 186+20 TO STA. 198+60
M30-R-64/ 4	15	TYPICAL SECTION STA. 198+60 TO STA. 203+40 & STA. 1+95 TO STA. 6+15
M30-R-64/ 5	16	PLAN & PROFILE STA. 126+00 TO STA. 136+00
M30-R-64/ 6	17	PLAN & PROFILE STA. 136+00 TO STA. 148+00
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M30-R-64/12	23	PLAN & PROFILE STA. 0+00 TO STA. 6+55
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M30-R-40/ 6	29	SILVER LAKE DAM PIER 3 SECTIONS
M30-R-40/ 7	30	SILVER LAKE DAM ACCESS BRIDGE & DETAILS
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M30-R-40/10	33	SILVER LAKE DAM MECHANICAL
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M30-R-61/ 3	39	DAKOTA, MINNESOTA & EASTERN R.R. BRIDGE SCOUR PROTECTION
M30-R-61/ 4	40	CENTER STREET BRIDGE SCOUR PROTECTION
M30-R-61/ 5	41	LT. BANK & RT. BANK FLOODWALL STA. 126+23 TO STA. 126+58 & STA. 125+73 TO STA. 126+58
M30-R-61/ 6	42	RIGHT BANK FLOODWALL STA. 169+40 TO STA. 174+79
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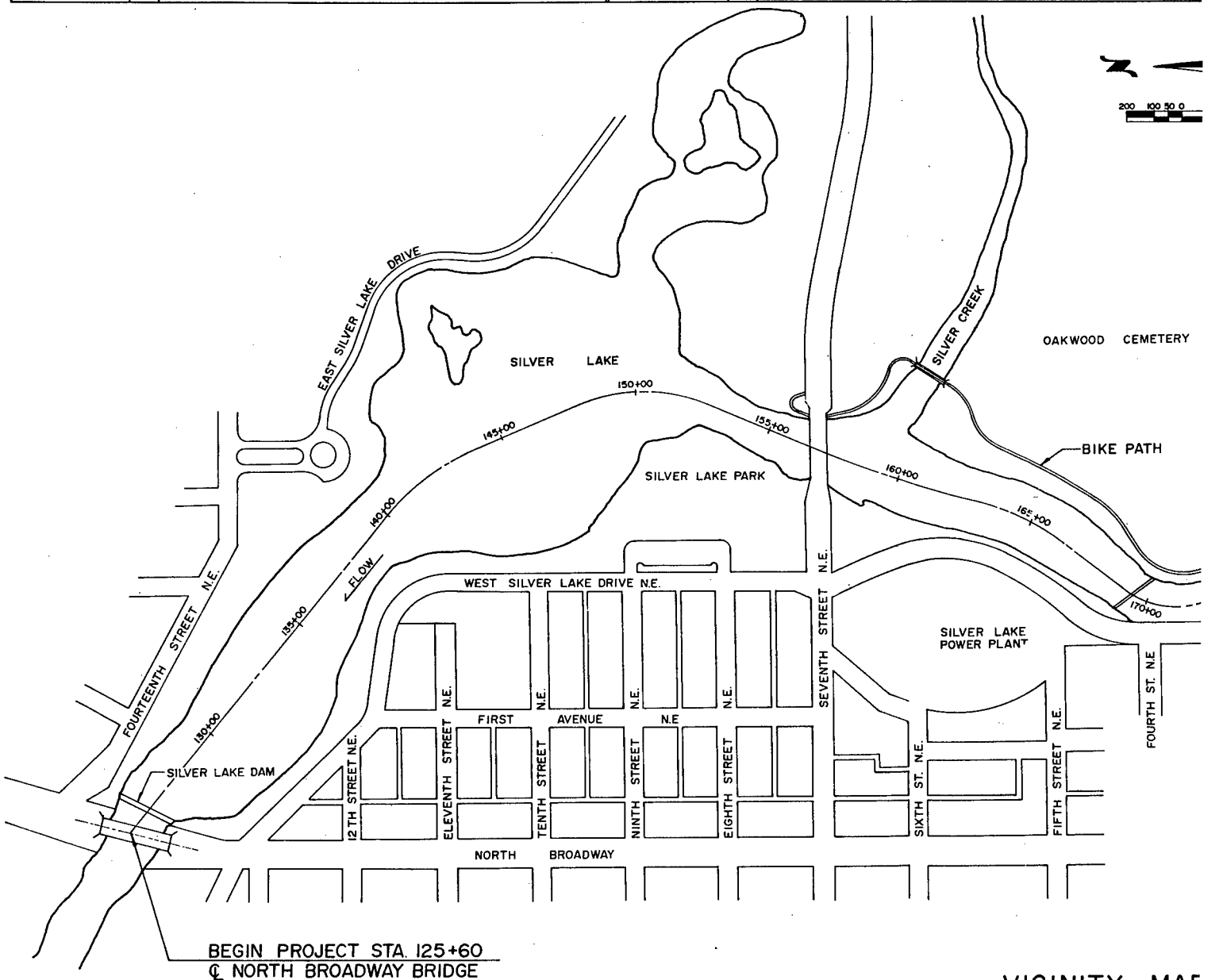
M30-R-61/15	51	LANDSCAPE DEVELOPMENT PLAN, STA. 177+00 TO STA. 182+00 (TYPICAL)



BEGIN PROJECT STA. 125+60
℄ NORTH BROADWAY BRIDGE

VICINITY MAP

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ING NO.	SHT.	TITLE
R-40/ 7	30	SILVER LAKE DAM ACCESS BRIDGE & DETAILS
R-40/ 8	31	SILVER LAKE DAM MECHANICAL PLAN & SECTIONS
R-40/ 9	32	SILVER LAKE DAM MECHANICAL PLAN & SECTIONS
R-40/10	33	SILVER LAKE DAM MECHANICAL
R-40/11	34	SILVER LAKE DAM
R-40/12	35	SILVER LAKE DAM
R-40/13	36	SILVER LAKE DAM
R-61/ 1	37	BROADWAY ST. BRIDGE SCOUR PROTECTION
R-61/ 2	38	SEVENTH STREET BRIDGE SCOUR PROTECTION
R-61/ 3	39	DAKOTA, MINNESOTA & EASTERN R.R. BRIDGE SCOUR PROTECTION
R-61/ 4	40	CENTER STREET BRIDGE SCOUR PROTECTION
R-61/ 5	41	LT. BANK & RT. BANK FLOODWALL STA. 126+23 TO STA. 126+58 & STA. 125+73 TO STA. 126+58
R-61/ 6	42	RIGHT BANK FLOODWALL STA. 169+40 TO STA. 174+79
R-61/ 7	43	LEFT BANK FLOODWALL STA. 172+40 TO STA. 186+25
R-61/ 8	44	DETAILS
R-61/ 9	45	BIKE PATH UNDERPASS CENTER STREET BRIDGE
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R-61/11	47	RIVER ACCESSES - STA. 195+20 RT. BANK, STA. 160+30, STA. 176+00, & STA. 196+00 LT. BANK
R-61/12	48	BICYCLE & PEDESTRIAN BRIDGE STA. 194 + 00
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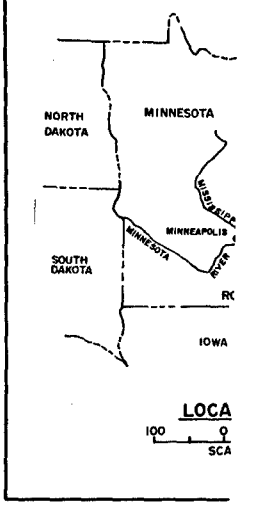
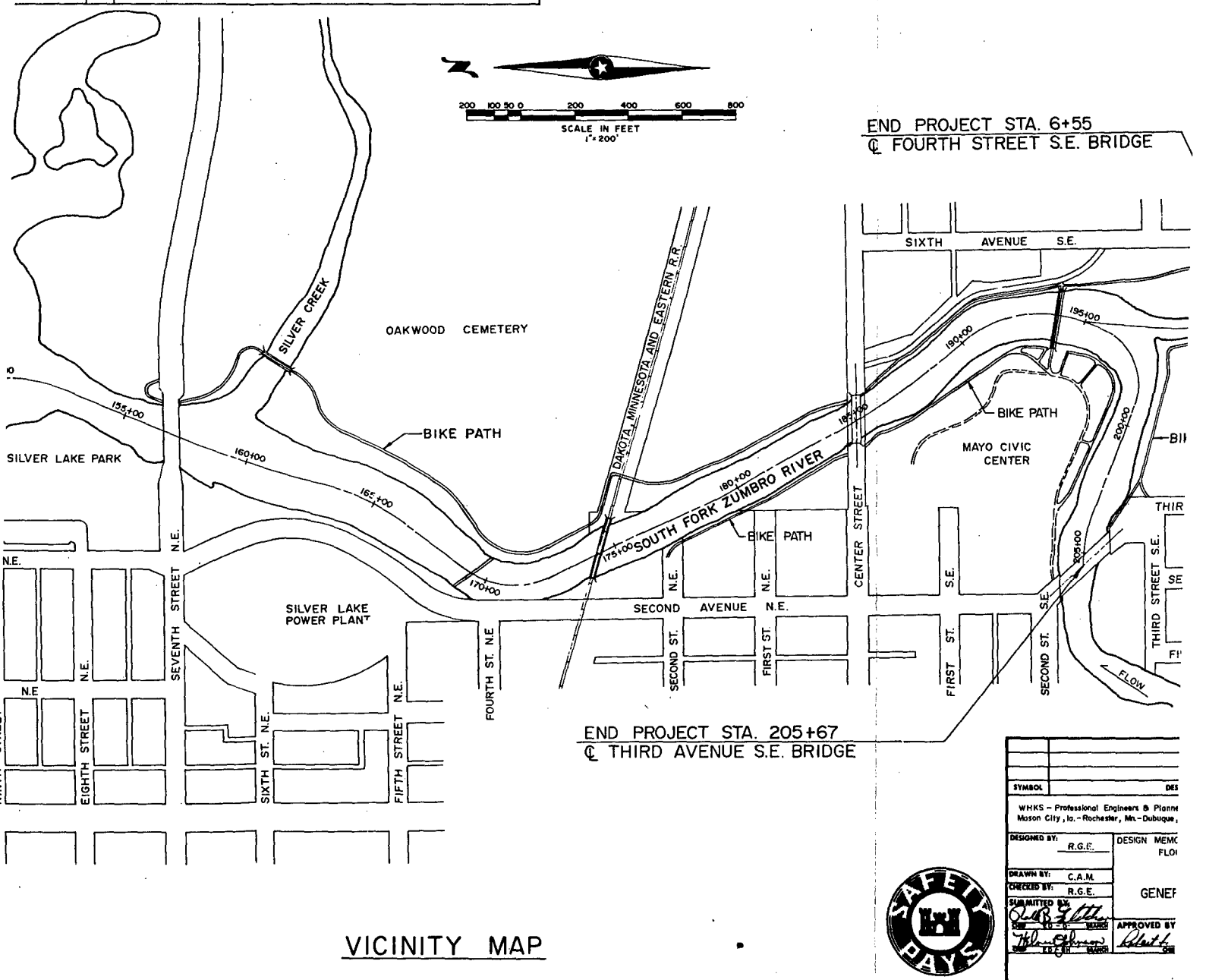
R-61/14	50	LIGHTING STANDARD, STEEL HANDRAIL, & GUARDPOST BARRIER
R-61/15	51	LANDSCAPE DEVELOPMENT PLAN, STA. 177+00 TO STA. 182+00 (TYPICAL)





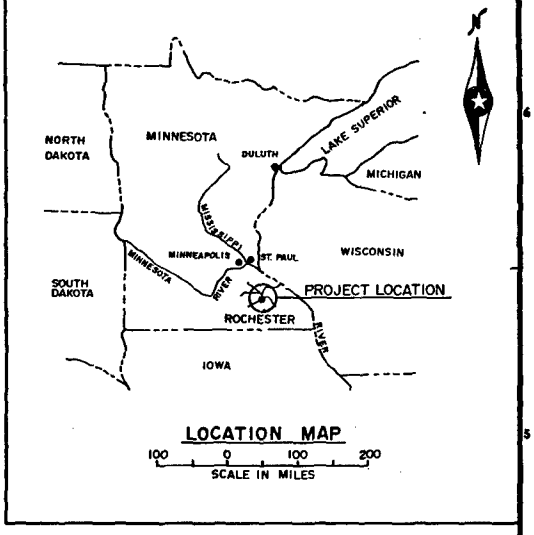
VICINITY MAP

SAFETY PAYS

SYMBOL | DES

WHKS – Professional Engineers & Planne
Mason City, Ia. - Rochester, Mn. - Dubuque,

DESIGNED BY: R.G.E. | DESIGN MEMO FLOO
DRAWN BY: C.A.M.
CHECKED BY: R.G.E. | GENEF
SUBMITTED BY: APPROVED BY



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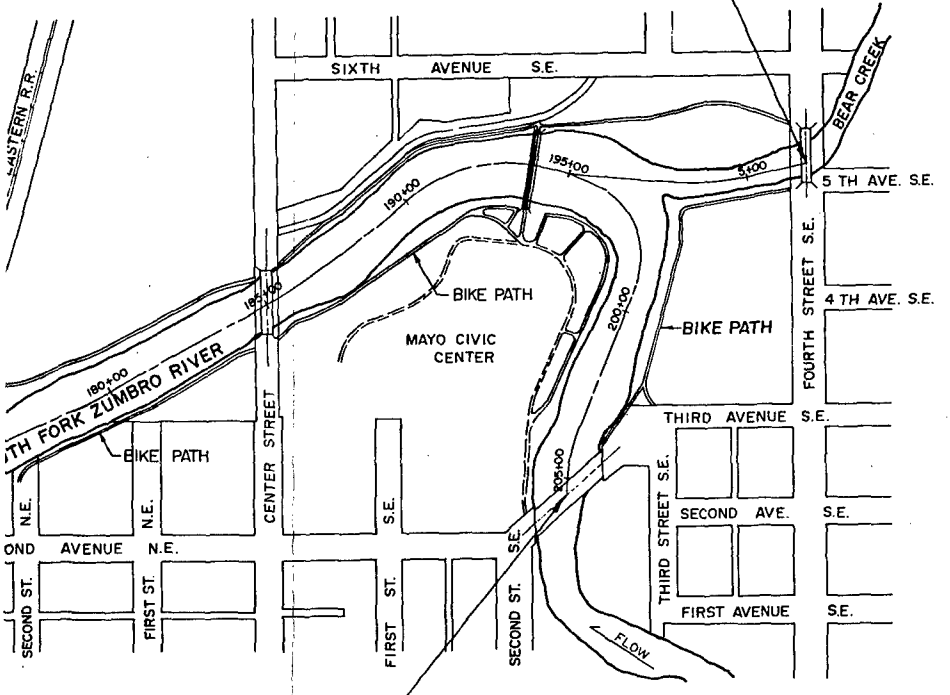


OJECT STA. 205+67
) AVENUE S.E. BRIDGE

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: R.G.E.
DRAWN BY: C.A.M.
CHECKED BY: R.G.E.
SUBMITTED BY:
CHIEF, ED-D BRANCH
CHIEF, ED-H BRANCH

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
GENERAL PLAN & DRAWING SCHEDULE

APPROVED BY:
CHIEF, ENGR. DIVISION

DATE:
APRIL 1988

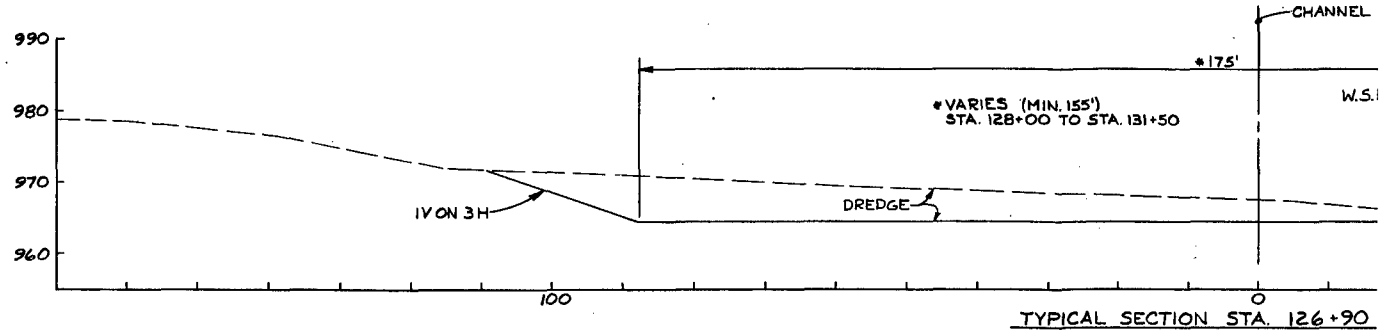
SCALE AS SHOWN
SPEC. NO.

DRAWING NUMBER
M30-R-10/1

SHEET 1 OF 51

SAFETY PAYS

PLATE 1



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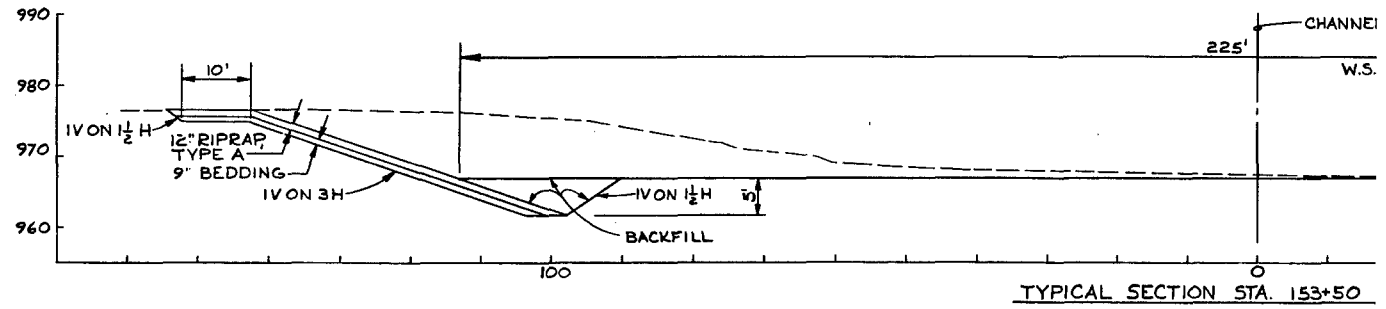

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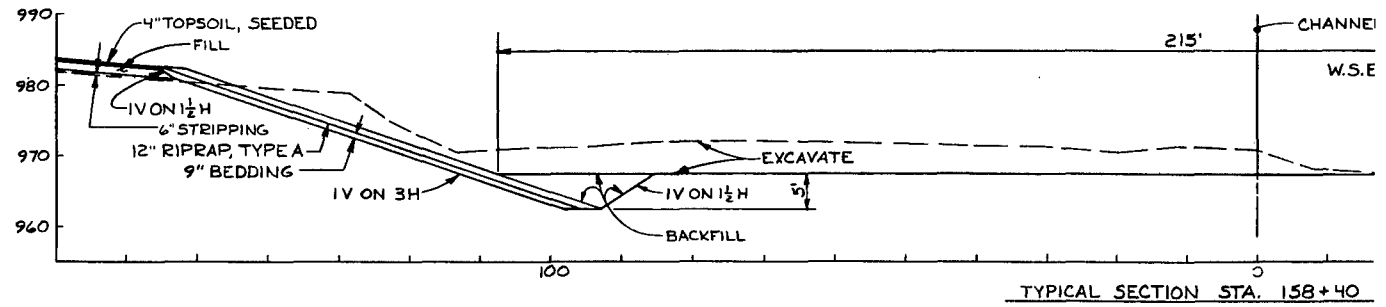

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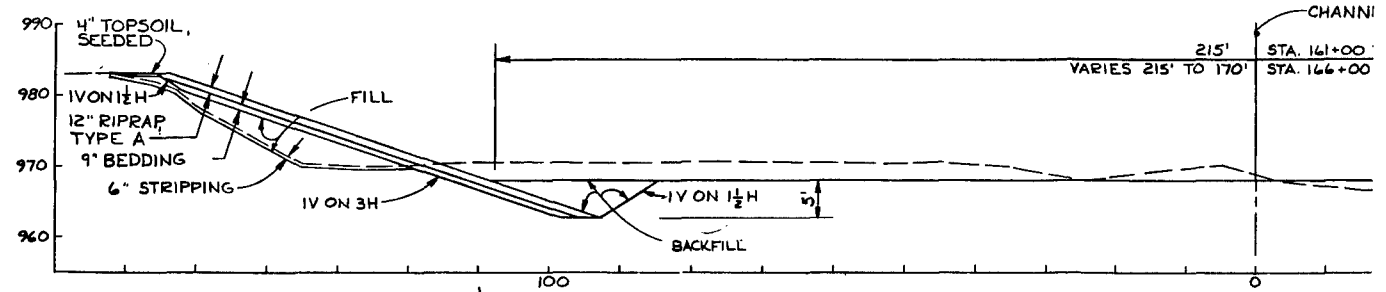

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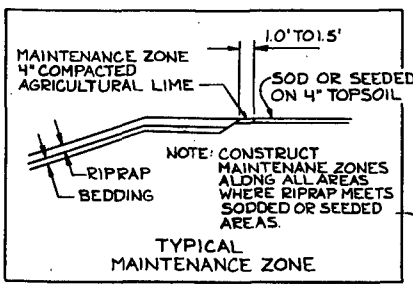

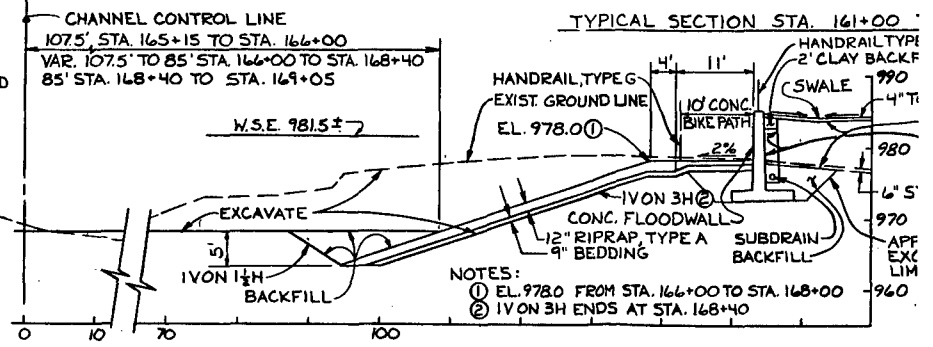

NOTES:
① EL. 978.0 FROM STA. 166+00 TO STA. 168+00
② 1V ON 3H ENDS AT STA. 168+40

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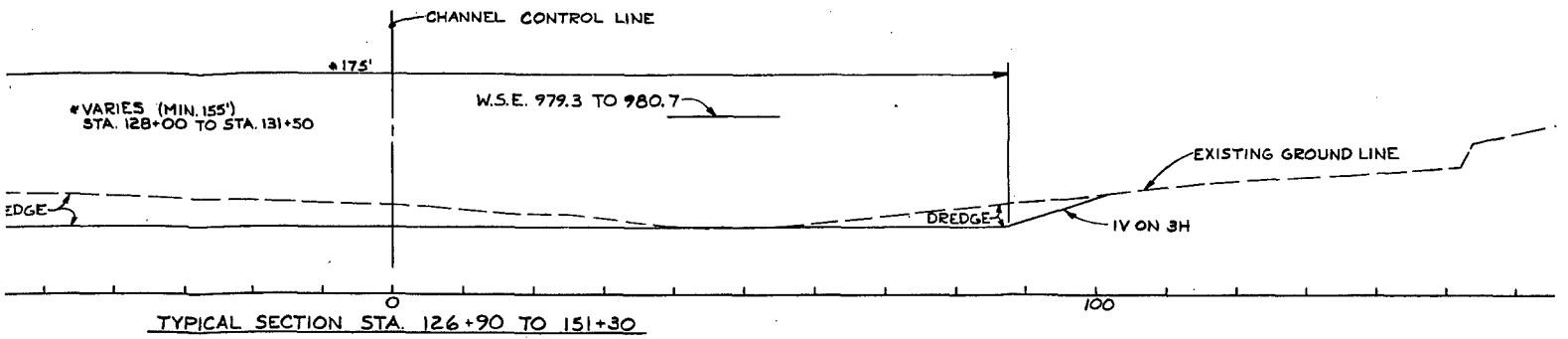

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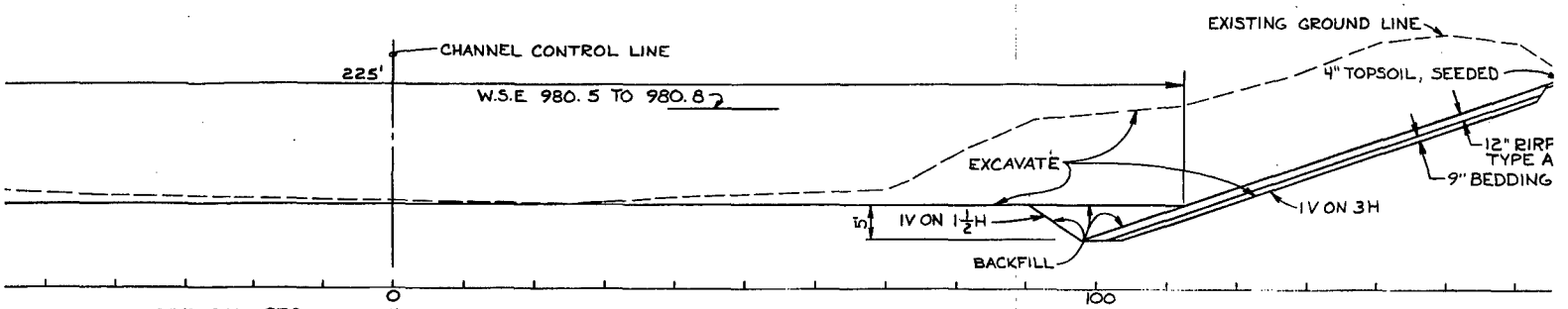

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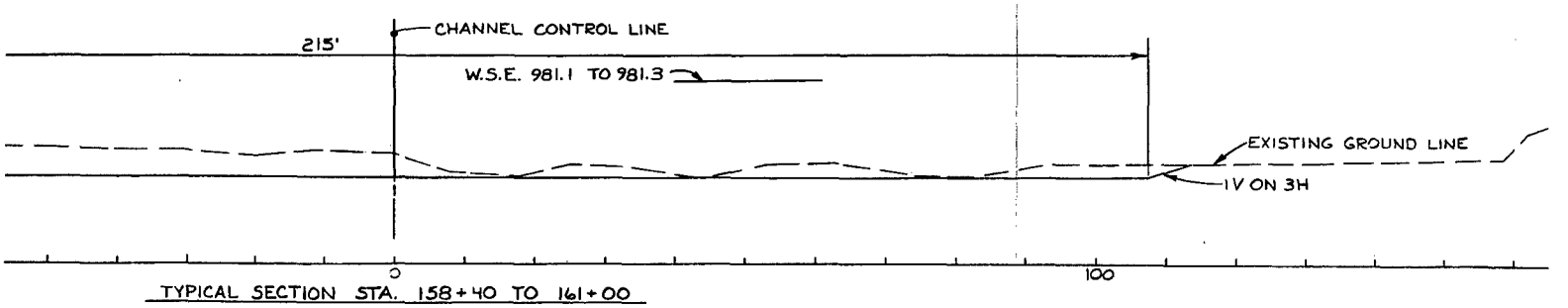

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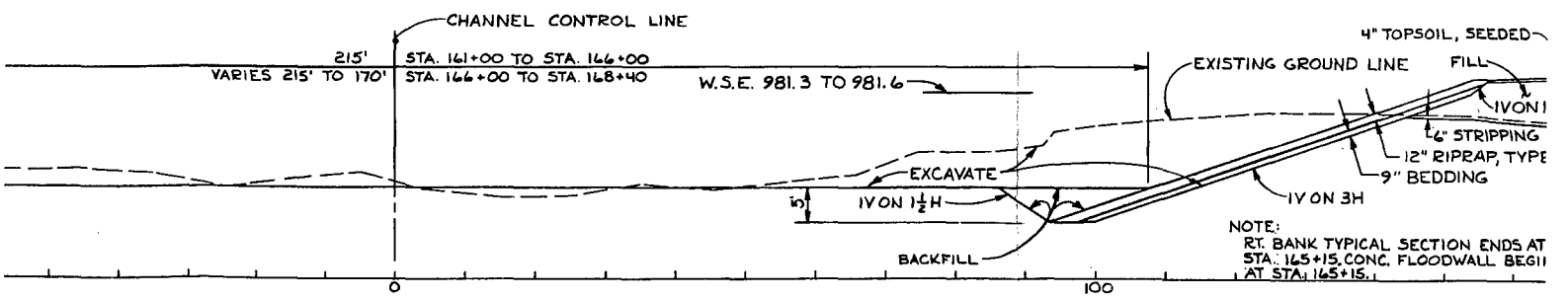

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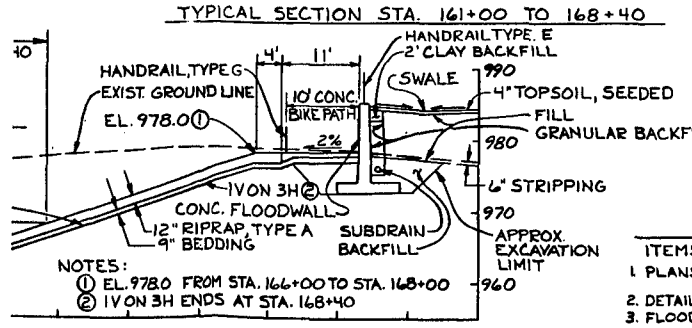

+15 RT. TO STA. 169+05 RT.

REFERENCES

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6. LIGHTING STANDARD, STEEL HANDRAIL	50

SAFETY PAYS

SYMBOL	DESCRIPTION

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

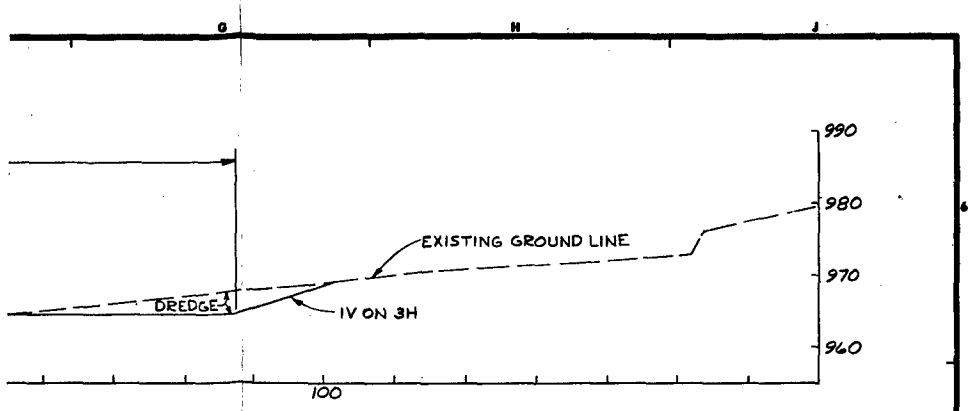
DEPART
ST. PAUL DI

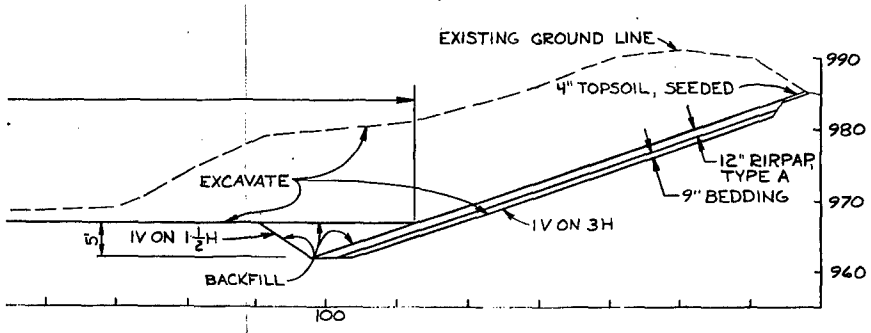
DESIGNED BY: D.O
DRAWN BY: K.R.R.
CHECKED BY: D.O
SUBMITTED BY:
DATE / CHIEF ENGINEER
DATE / ENGINEER OF DESIGN
APPROVED BY:
CHIEF ENGINEER, HYDRAULIC DIVISION

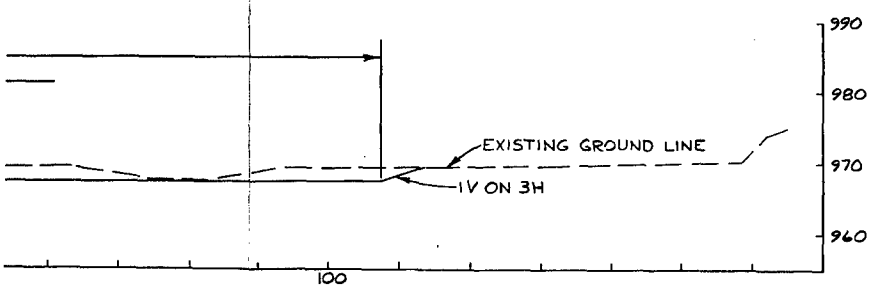
DESIGN MEMORANDUM NO. 2
FLOOD CONTROL SOUTH
ROCHESTER, M
STAGE
TYPICAL SE
STA. 126+90 TO

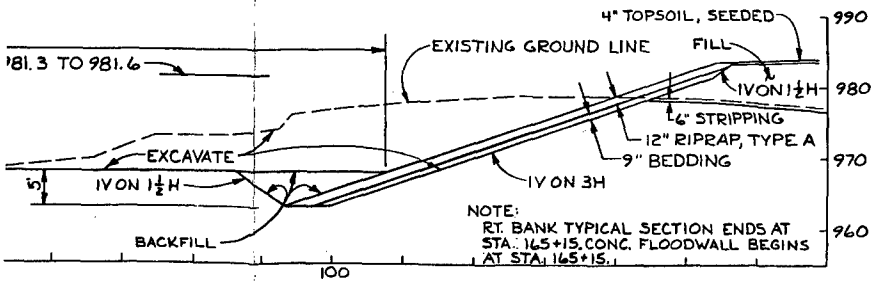
SCALE: AS SH

SHEET 12









SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: D.O
DRAWN BY: K.R.R.
CHECKED BY: D.O
SUBMITTED BY:
APPROVED BY:

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
TYPICAL SECTIONS
STA. 126+90 TO STA. 168+40

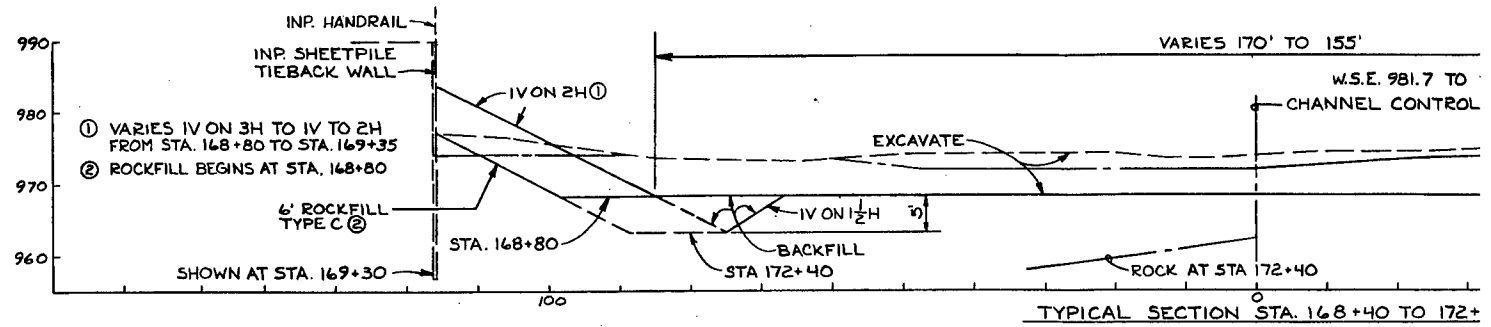
DATE: APRIL 1988
SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER: M30-R-64/1
SHEET 12 OF 51

RENCES

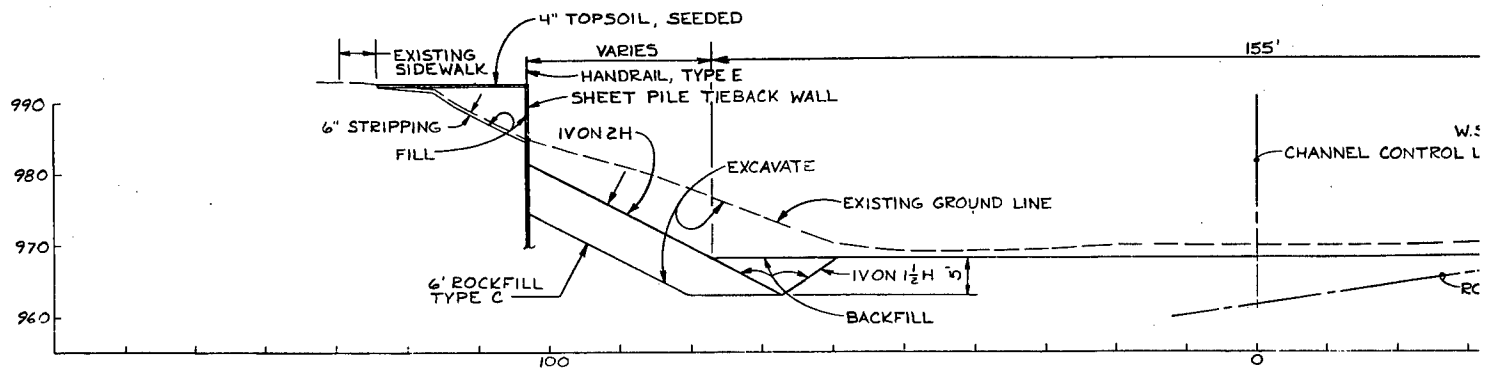
	SHEET NO.(S)
.E	16, 17, 18, + 19
LL A	43
NLS	46
	47
LS	49
D, STEEL HANDRAIL	50

SAFETY PAYS

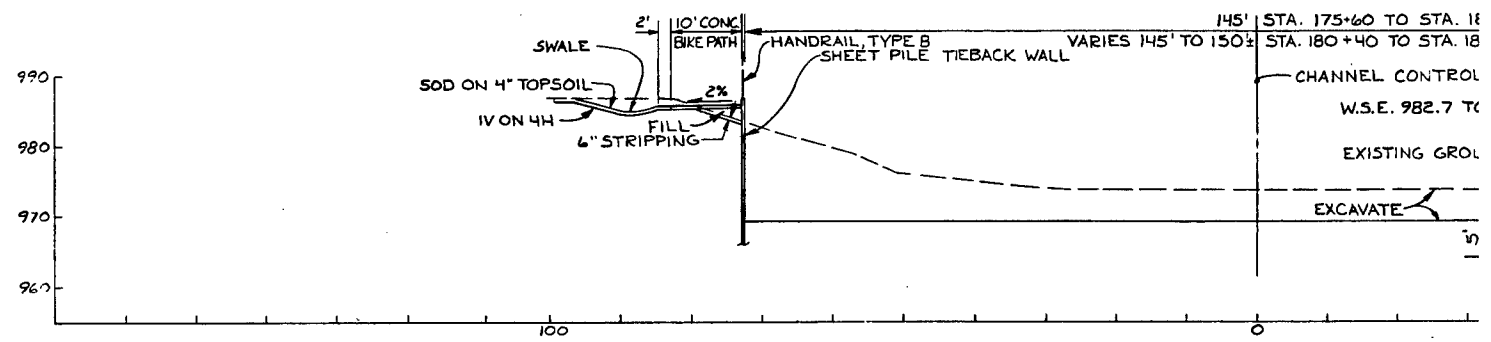
PLATE 12



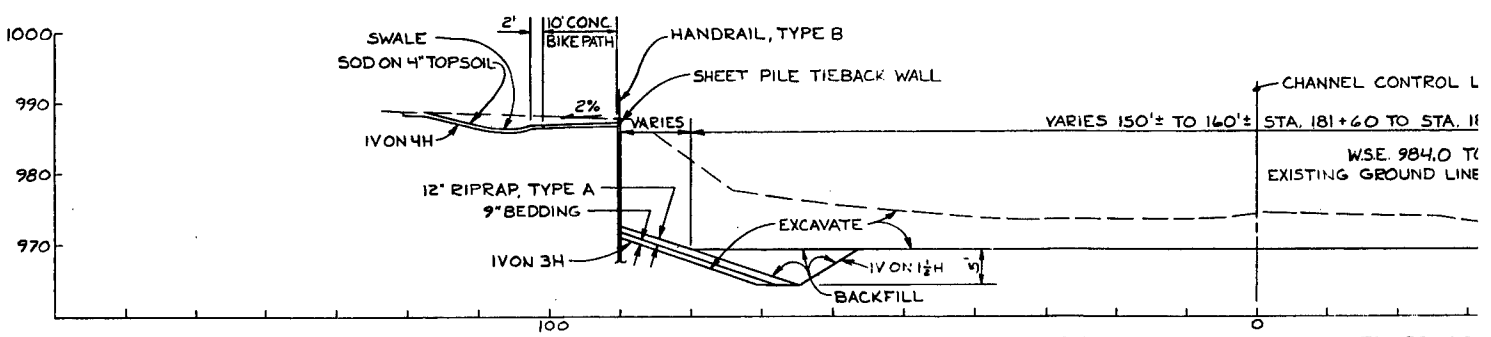
TYPICAL SECTION STA. 168+40 TO 172+



TYPICAL SECTION STA. 172+40 TO 173

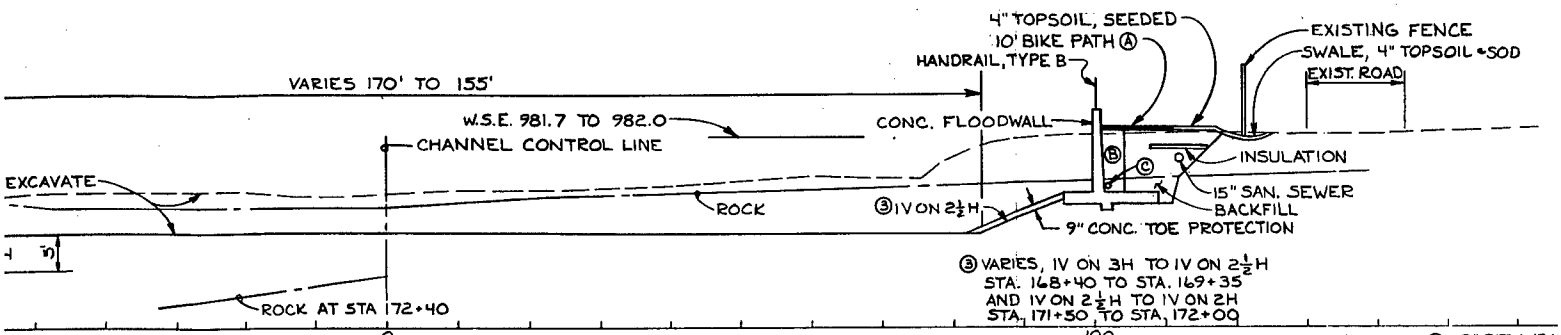


TYPICAL SECTION STA. 175+60 TO 181+60



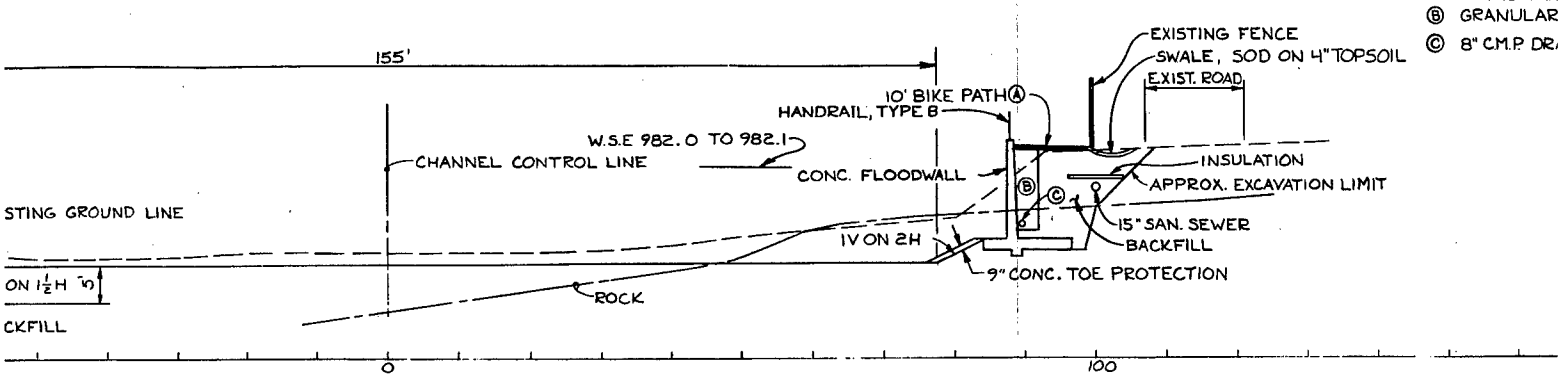
TYPICAL SECTION STA. 181+60 TO 182+60

1.
2.
3.
4.
5.
6.
7.
8.

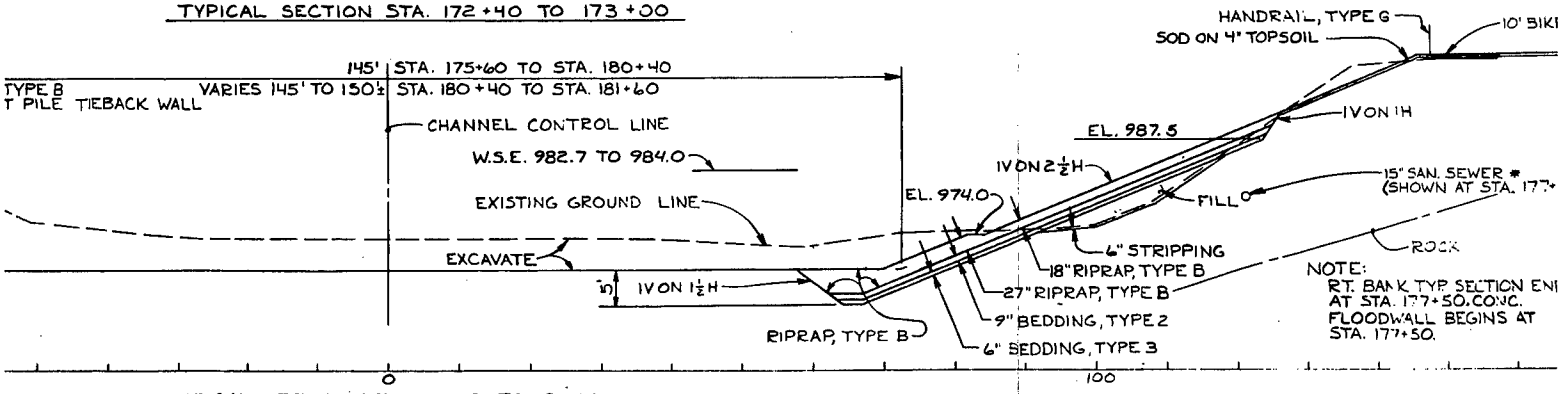


TYPICAL SECTION STA. 168+40 TO 172+40

NOTES: Ⓐ 2" BIT. WEA
4" CRUSHEI
Ⓑ GRANULAR
Ⓒ 8" CM.P DR

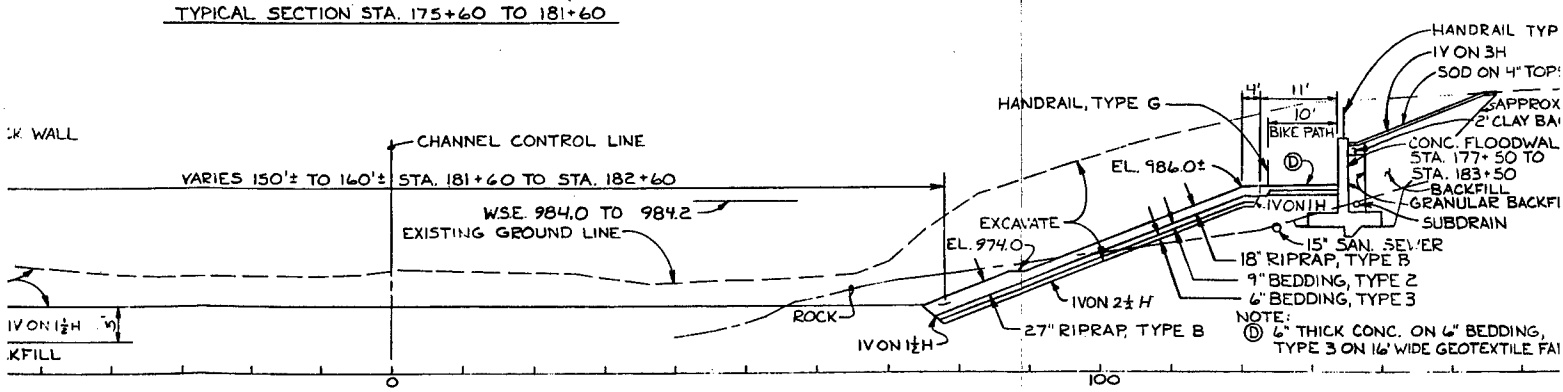


TYPICAL SECTION STA. 172+40 TO 173+00



NOTE:
RT. BANK TYP. SECTION EN
AT STA. 177+50. CONC.
FLOODWALL BEGINS AT
STA. 177+50.

TYPICAL SECTION STA. 175+60 TO 181+60



NOTE:
Ⓓ 4" THICK CONC. ON 6" BEDDING,
TYPE 3 ON 16' WIDE GEOTEXTILE FA

TYPICAL SECTION STA. 181+60 TO 182+60

REFERENCES

ITEM	SHEET NO.(S)
1. PLAN + PROFILE	19 + 20
2. DAKOTA + MINNESOTA EASTERN RR. BRIDGE SCOUR PROTECTION	39
3. RT. BANK FLOODWALL STA. 169+40 TO STA. 174+79	42
4. LT. BANK FLOODWALL STA. 172+40 TO STA. 186+25	43
5. FLOODWALL DETAILS	46
6. RIVER ACCESSES	47
7. LIGHTING STANDARD, STEEL HANDRAIL	50
8. LANDSCAPE DEVELOPMENT PLAN, STA. 177+00 TO STA. 182+00 (TYP)	51

SAFETY PAYS

SYMBOL	DESCRIPTION

WHKS – Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

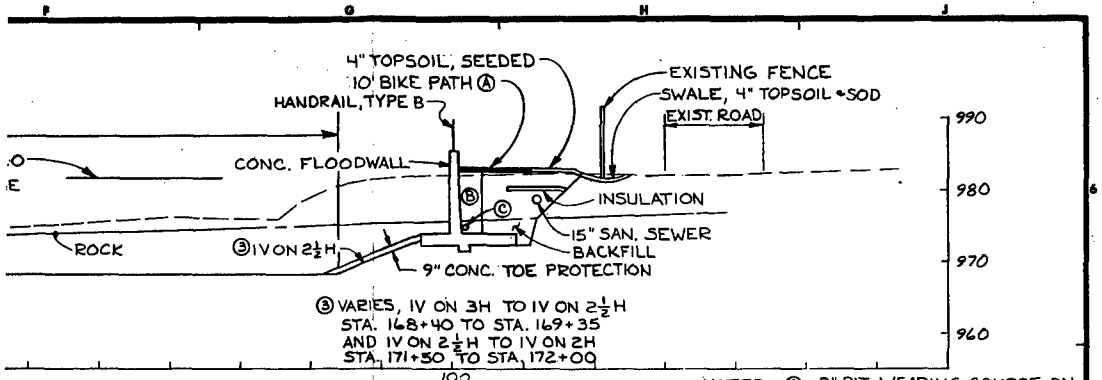
DEPARTA
ST. PAUL DIS
ST.

DESIGNED BY: D.O.
DRAWN BY: K.R.R.
CHECKED BY: D.O
SUBMITTED BY:
APPROVED BY:

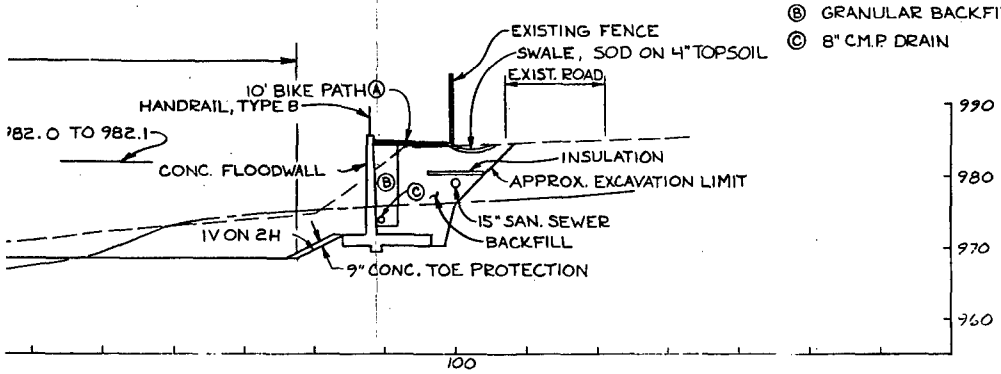
DESIGN MEMORANDUM NO. 2
FLOOD CONTROL SOUTH F
ROCHESTER, MI
STAGE
TYPICAL SEC
STA. 168+40 TO S

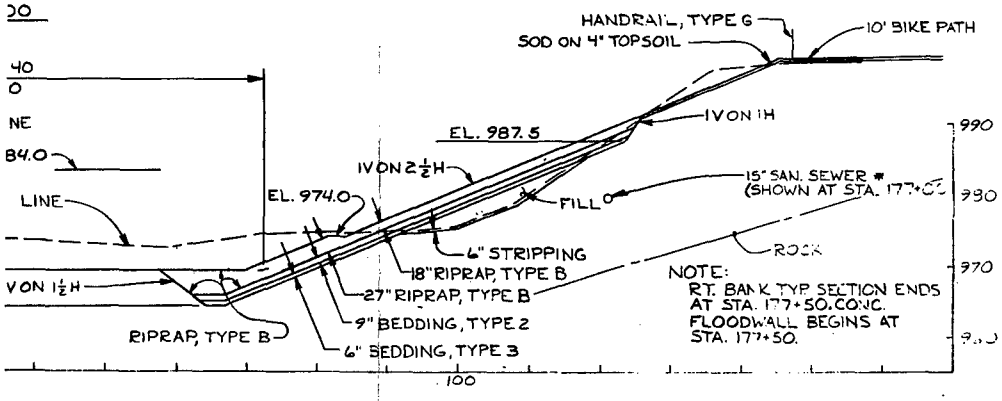
SCALE: AS SH

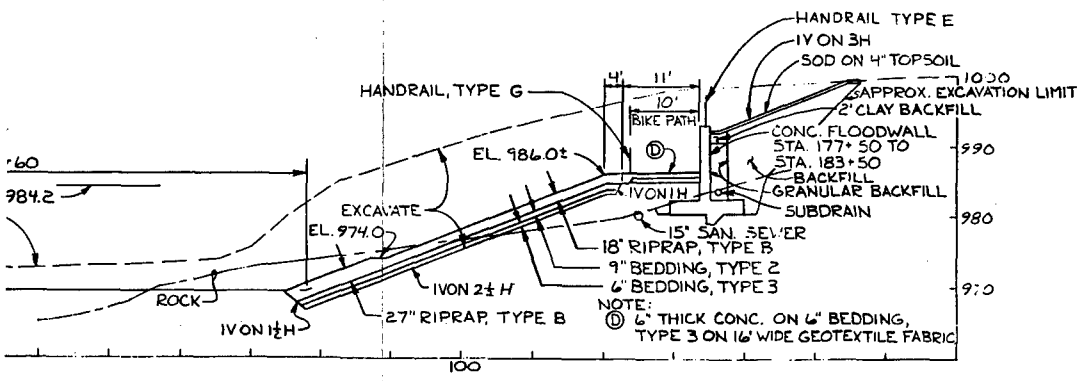
SHEET 13



NOTES: Ⓐ 2" BIT. WEARING COURSE ON 4" CRUSHED ROCK BASE
Ⓑ GRANULAR BACKFILL
Ⓒ 8" C.M.P. DRAIN







REFERENCES

	SHEET NO.(S)
.M	
AN & PROFILE	19 & 20
KOTA & MINNESOTA STERN RR. BRIDGE DUR PROTECTION	39
BANK FLOODWALL A. 169+40 TO STA. 174+79	42
BANK FLOODWALL A. 172+40 TO STA. 186+25	43
DODWALL DETAILS	46
ER ACCESSES	47
HTING STANDARD, STEEL HANDRAIL	50
NDSCAPE DEVELOPMENT PLAN, A. 177+00 TO STA. 182+90 (TYP.)	51

SAFETY PAYS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

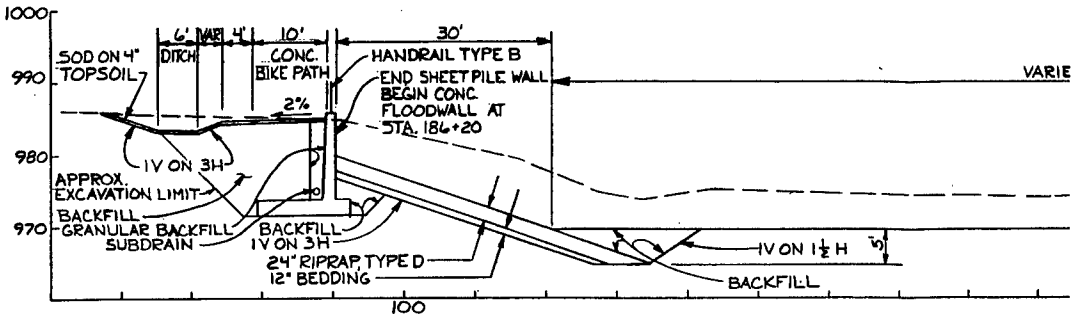
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: D.O.
DRAWN BY: K.R.R.
CHECKED BY: D.O
SUBMITTED BY:

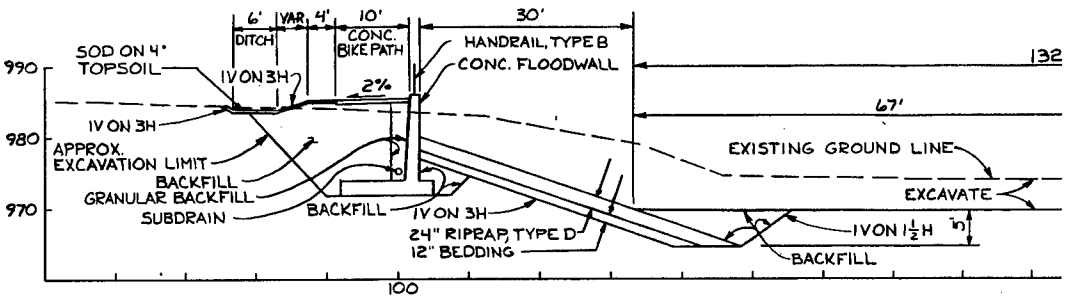
DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
TYPICAL SECTIONS
STA. 168+40 TO STA. 182+60

APPROVED BY: Robert L. Post, CHIEF ENGR. DIVISION
DATE: APRIL 1988
SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER M30-R-64/2
SHEET 13 OF 81

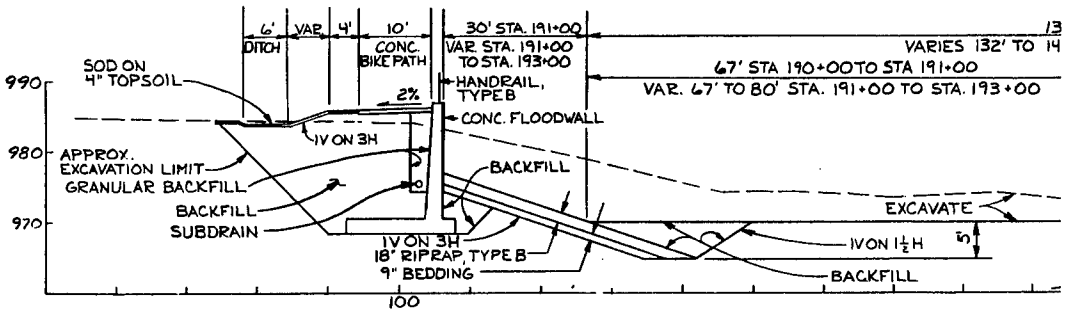
PLATE 13



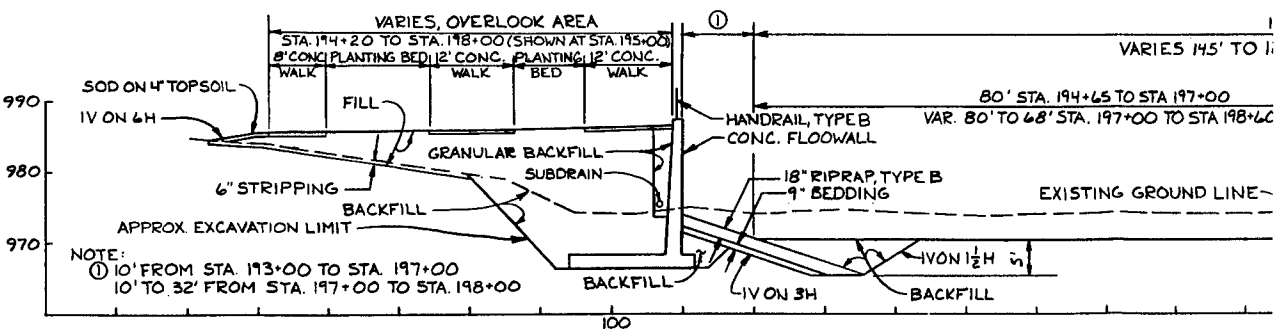
TYPICAL SECTIO



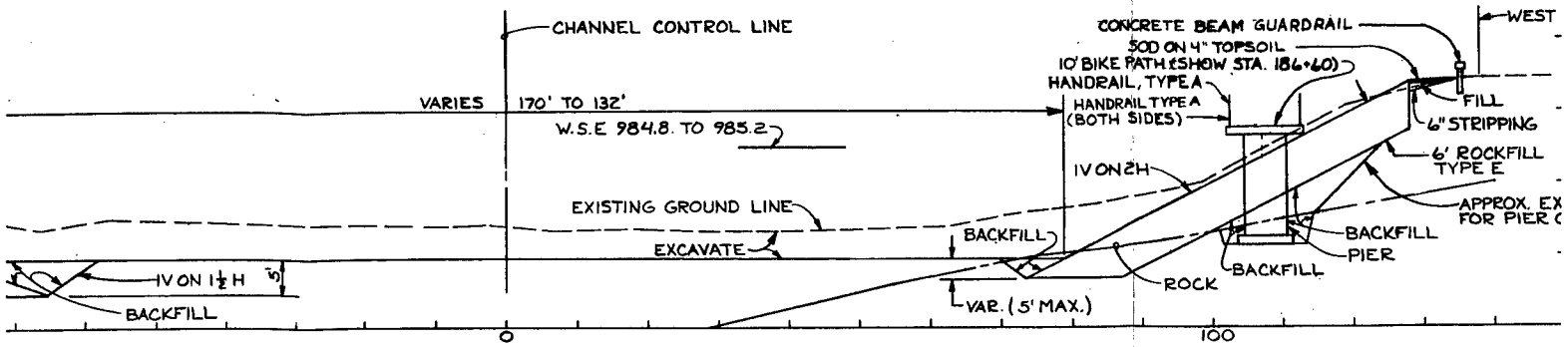
TYPICAL SECTION



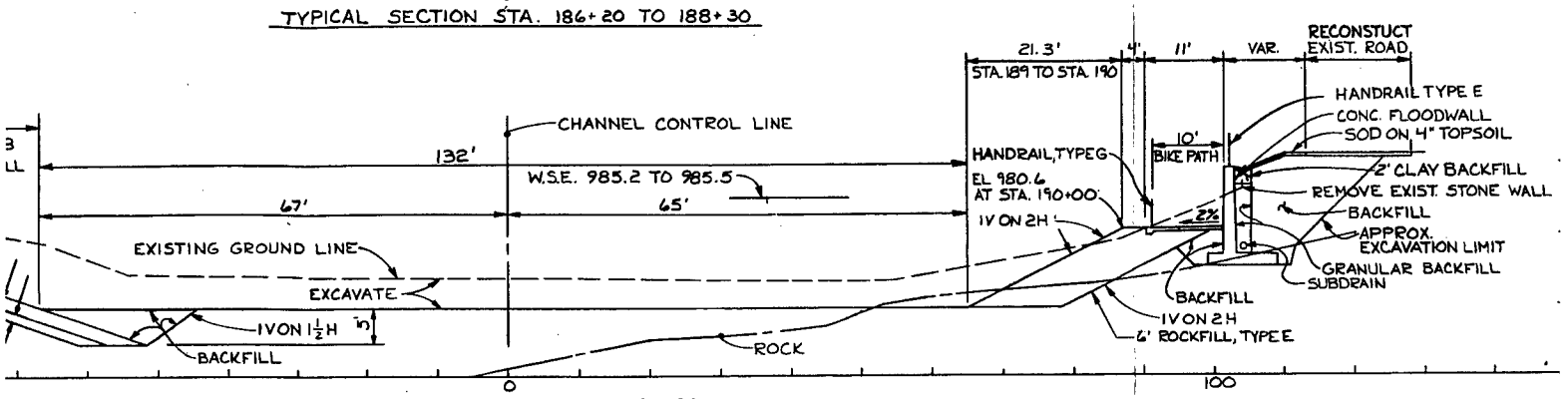
TYPICAL SECTION



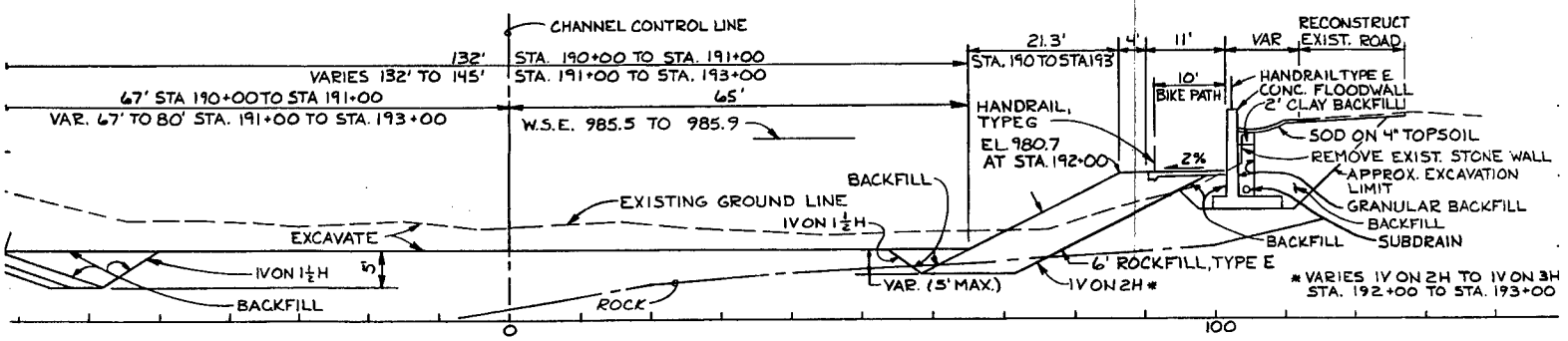
TYPICAL SECTION



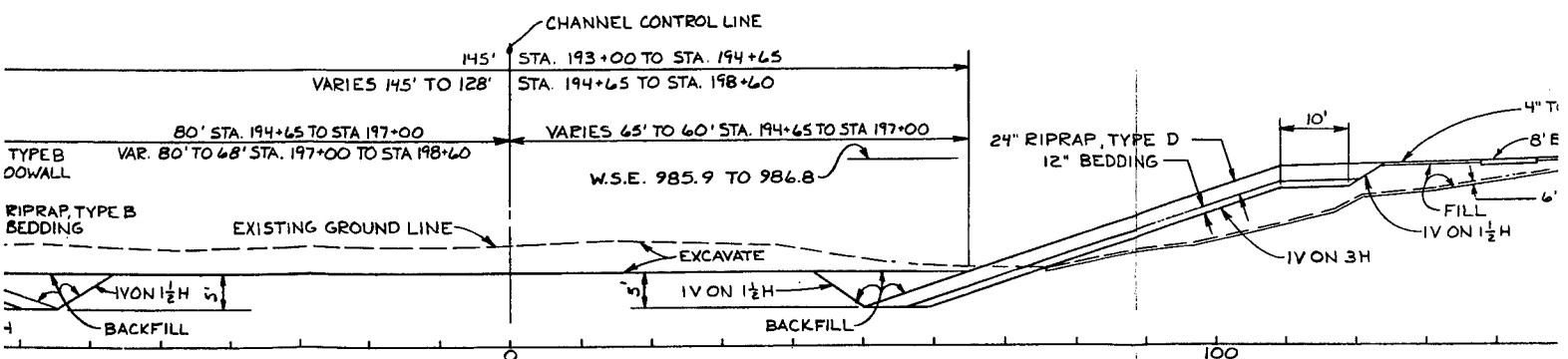
TYPICAL SECTION STA. 186+20 TO 188+30



TYPICAL SECTION STA. 188+30 TO 190+00



TYPICAL SECTION STA. 190+00 TO 193+00



TYPICAL SECTION STA. 193+00 TO 198+60

REFERENCES

ITEMS	SHEET NO. (S)
1. PLAN + PROFILE	21 + 22
2 BIKE PATH UNDERPASS	45
3. FLOODWALL DETAILS	46
4. RIVER ACCESS	47
5. BICYCLE + PEDESTRIAN BRIDGE	48
6. LIGHTING STANDARD, STEEL HANDRAIL, & GUARD POST BARRIERS	50

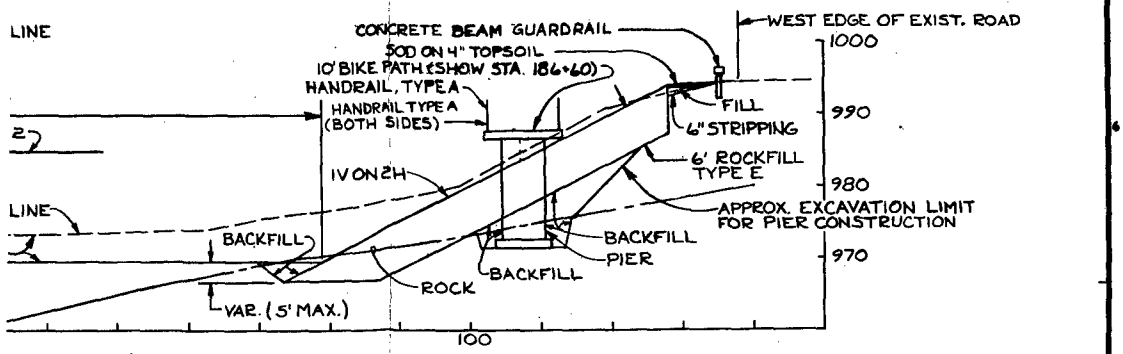
SAFETY PAYS

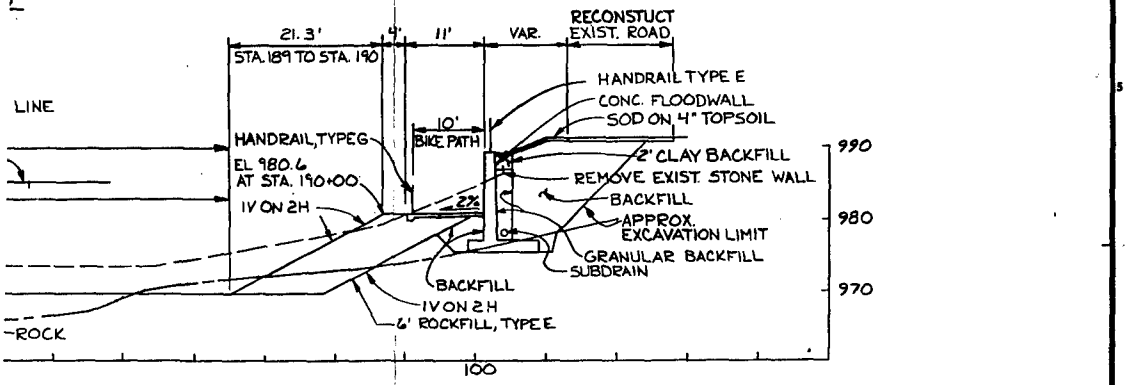
SYMBOL	DESCRIP

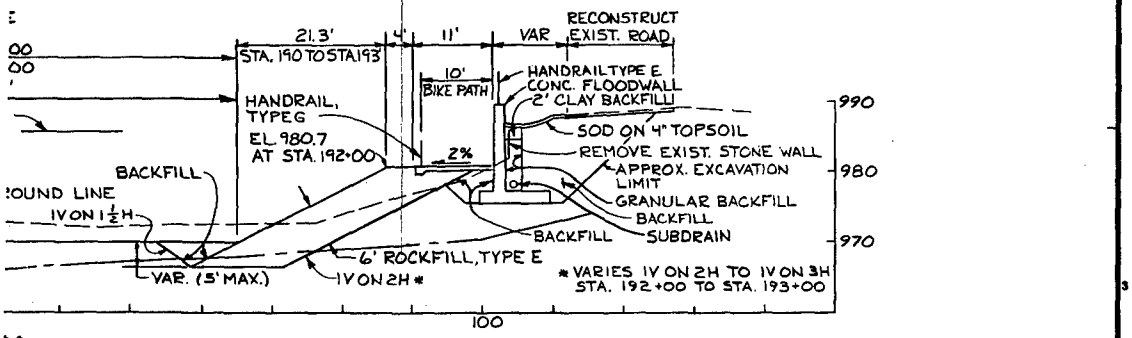
WHKS — Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

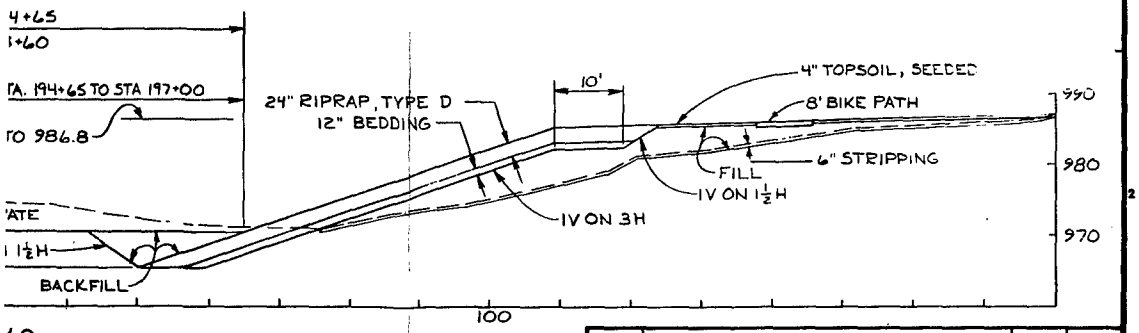
DESIGNED BY: D.O.
DRAWN BY: K.R.R
CHECKED BY: D.O.
SUBMITTED BY:
APPROVED BY:

DESIGN MEMORAI
FLOOD









REFERENCES	
TEMS	SHEET NO.(S)
PLAN + PROFILE	21 + 22
CLE PATH UNDERPASS	45
OODWALL DETAILS	46
VER ACCESS	47
CYCLE + PEDESTRIAN BRIDGE	48
GHTING STANDARD, STEEL HANDRAIL,	
ARD POST BARRIERS	50

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

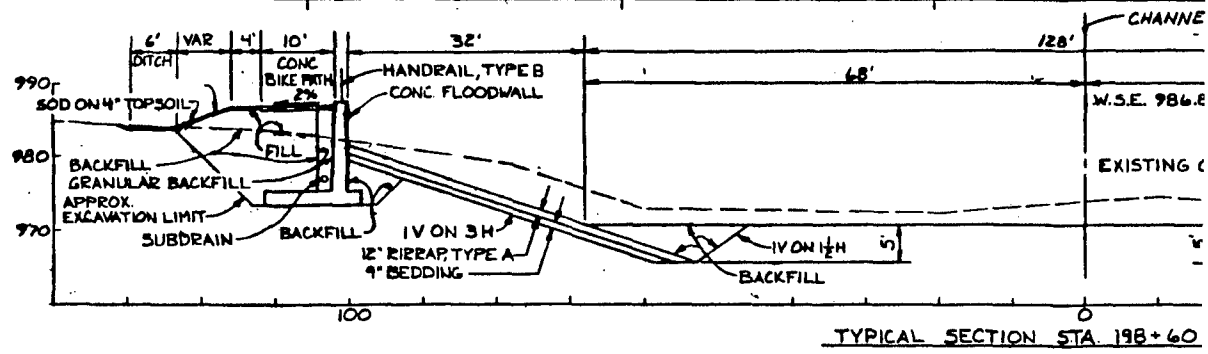
DESIGNED BY: D.O.
DRAWN BY: K.R.R
CHECKED BY: D.O.
SUBMITTED BY:
APPROVED BY:

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
TYPICAL SECTIONS
STA. 186+20 TO STA 198+60

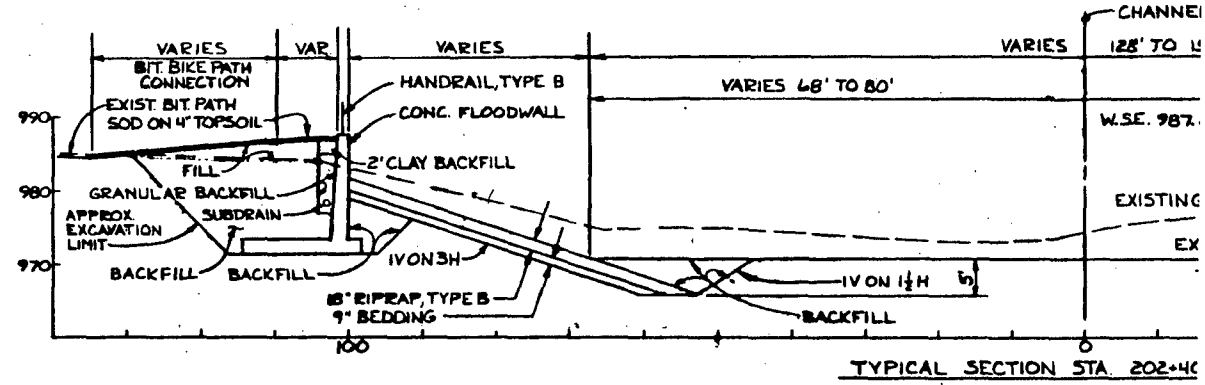
DATE: APRIL 1988
SCALE: AS SHOWN
SPEC NO.
DRAWING NUMBER: M30-R-64/3
SHEET 14 OF 91

SAFETY DAYS

PLATE 14

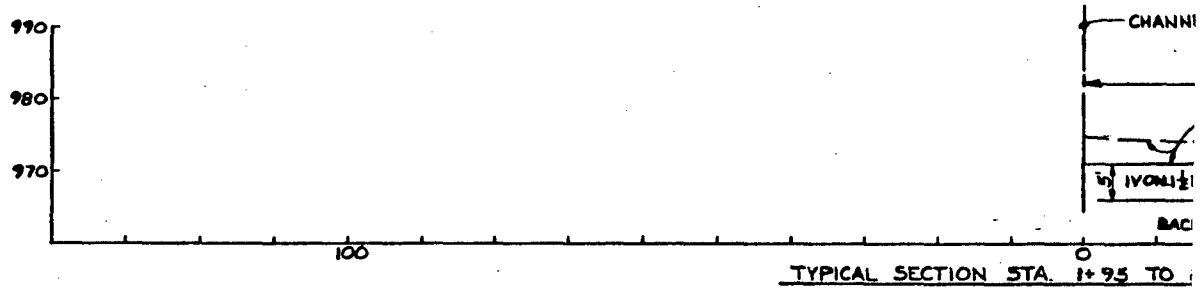


TYPICAL SECTION STA. 198+60

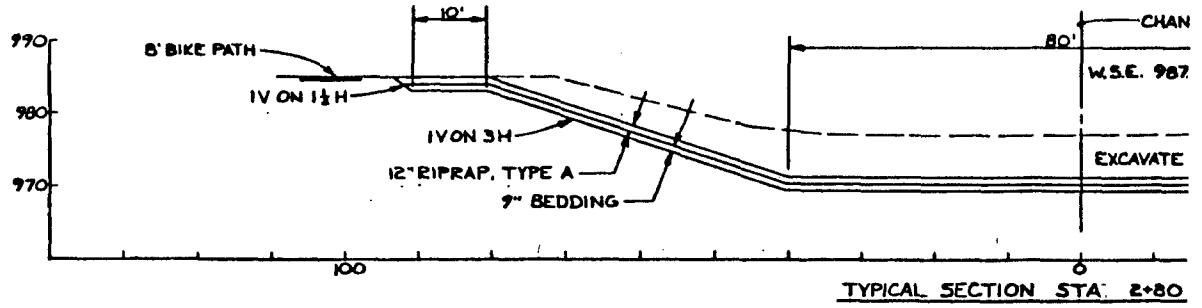


TYPICAL SECTION STA. 202+40

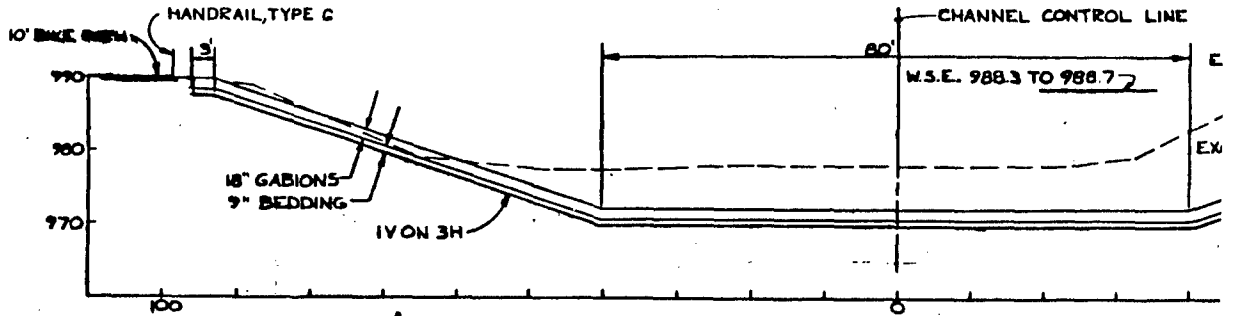
BEAR CREE



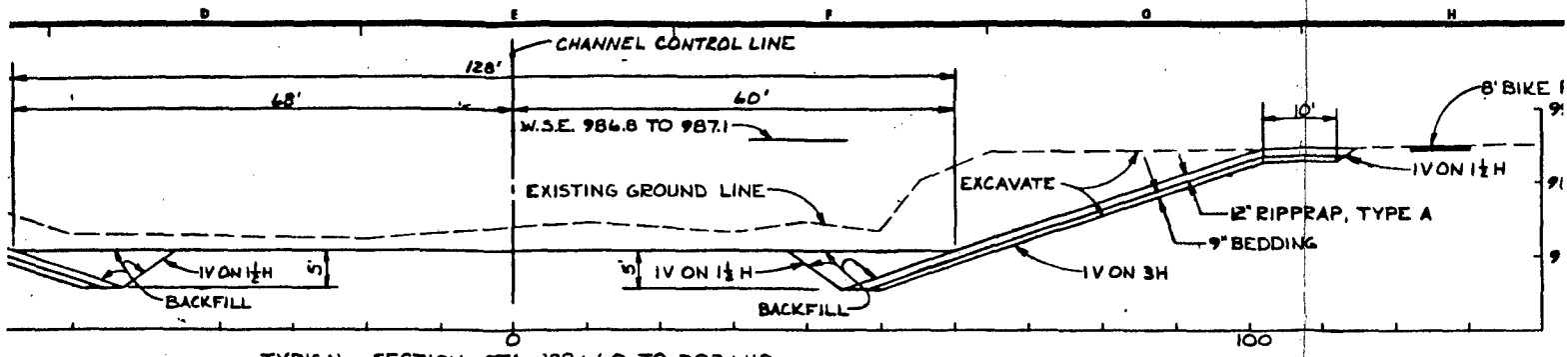
TYPICAL SECTION STA. 1+95 TO



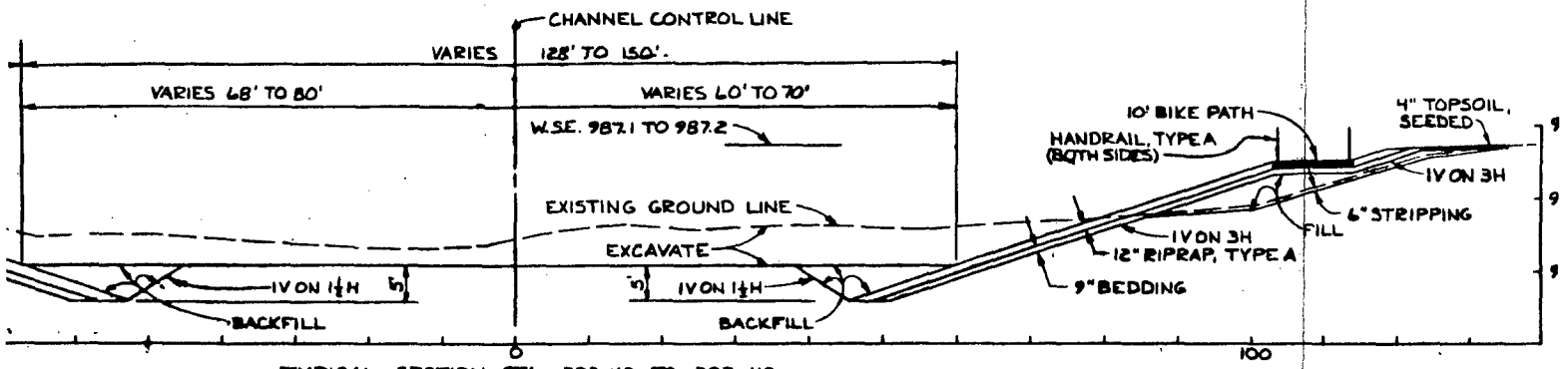
TYPICAL SECTION STA. 2+80



TYPICAL SECTION STA. 5+20 TO 6+15

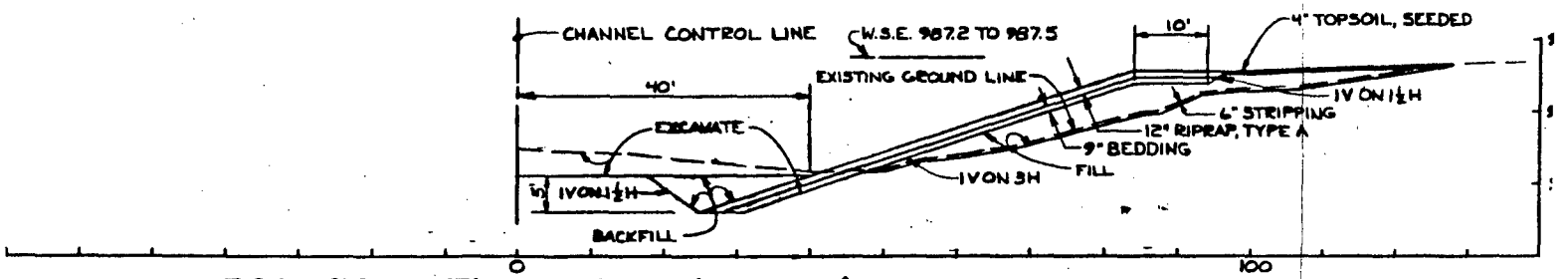


TYPICAL SECTION STA. 198+60 TO 202+40

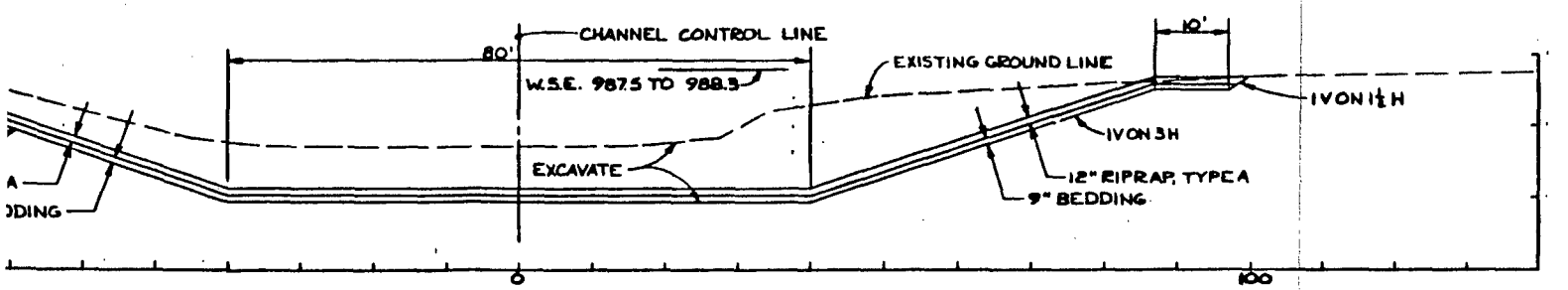


TYPICAL SECTION STA. 202+40 TO 203+40

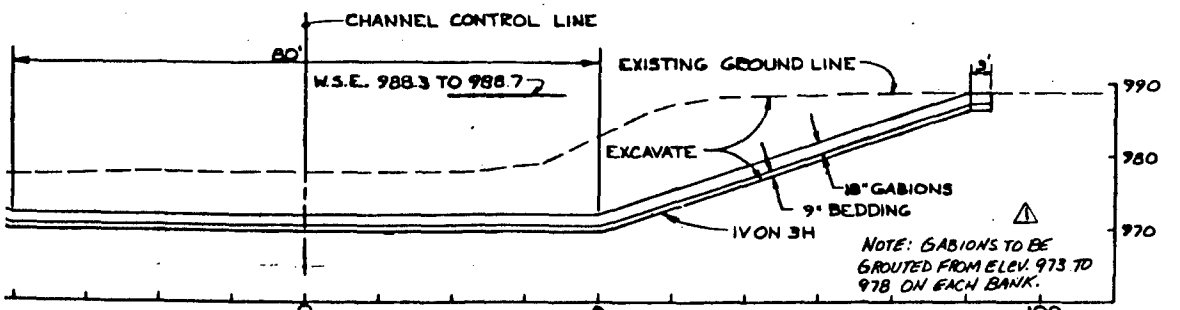
BEAR CREEK



TYPICAL SECTION STA. 1+95 TO 2+80 (RT. SIDE ONLY)



TYPICAL SECTION STA. 2+80 TO 5+20



TYPICAL SECTION STA. 5+20 TO 6+15

NOTE: GABIONS TO BE GROUTED FROM ELEV. 973 TO 978 ON EACH BANK.

2

⚠	REVISED
SYMBOL	

WHKS – Professional Engineers & Mason City, Ia. – Rochester, Minn. – D

DESIGNED BY: D.O. DESIGN

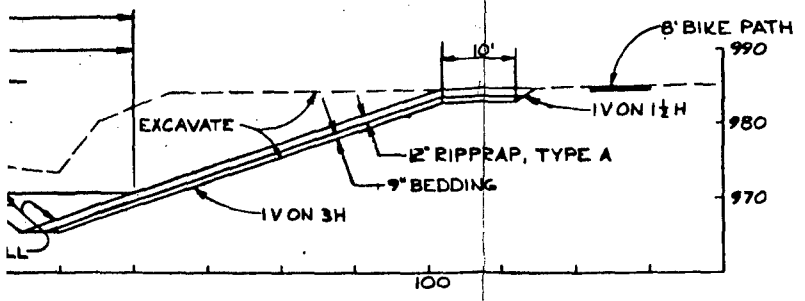
DRAWN BY: K.R.R.

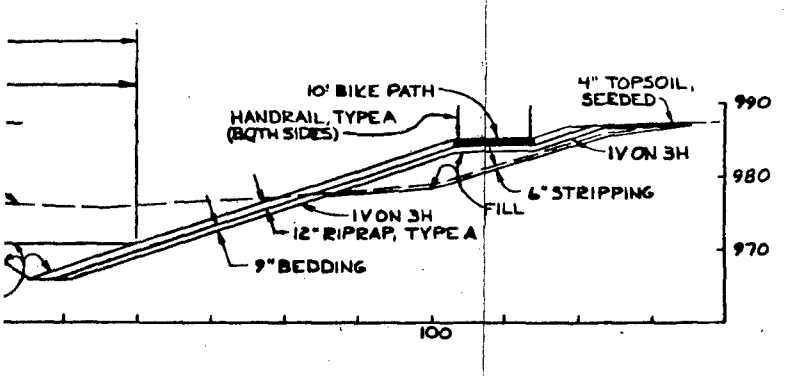
CHECKED BY: D.O.

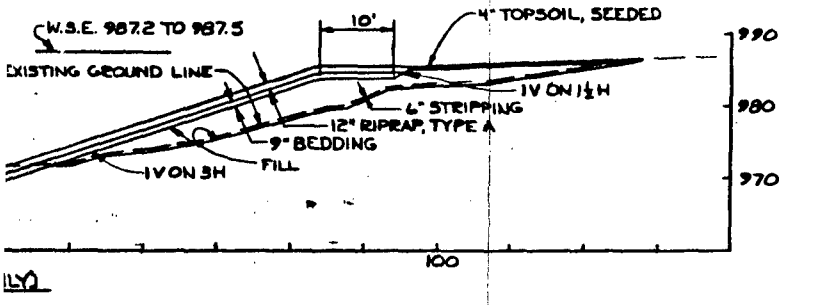
SUBMITTED BY:

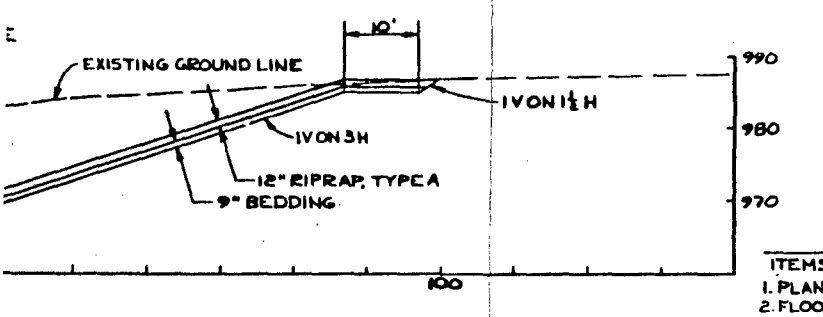
STA. 19

APPROV



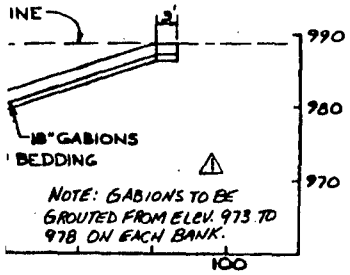






REFERENCES

ITEMS	SHEET NO.
1. PLAN & PROFILE	22 & 23
2. FLOODWALL DETAILS	46
3. LIGHTING STANDARD, STEEL HANDRAIL	50



SYMBOL	DESCRIPTION	DATE	APPROVAL
⚠	REVISED	NOV 88	G.V.R.

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Minn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

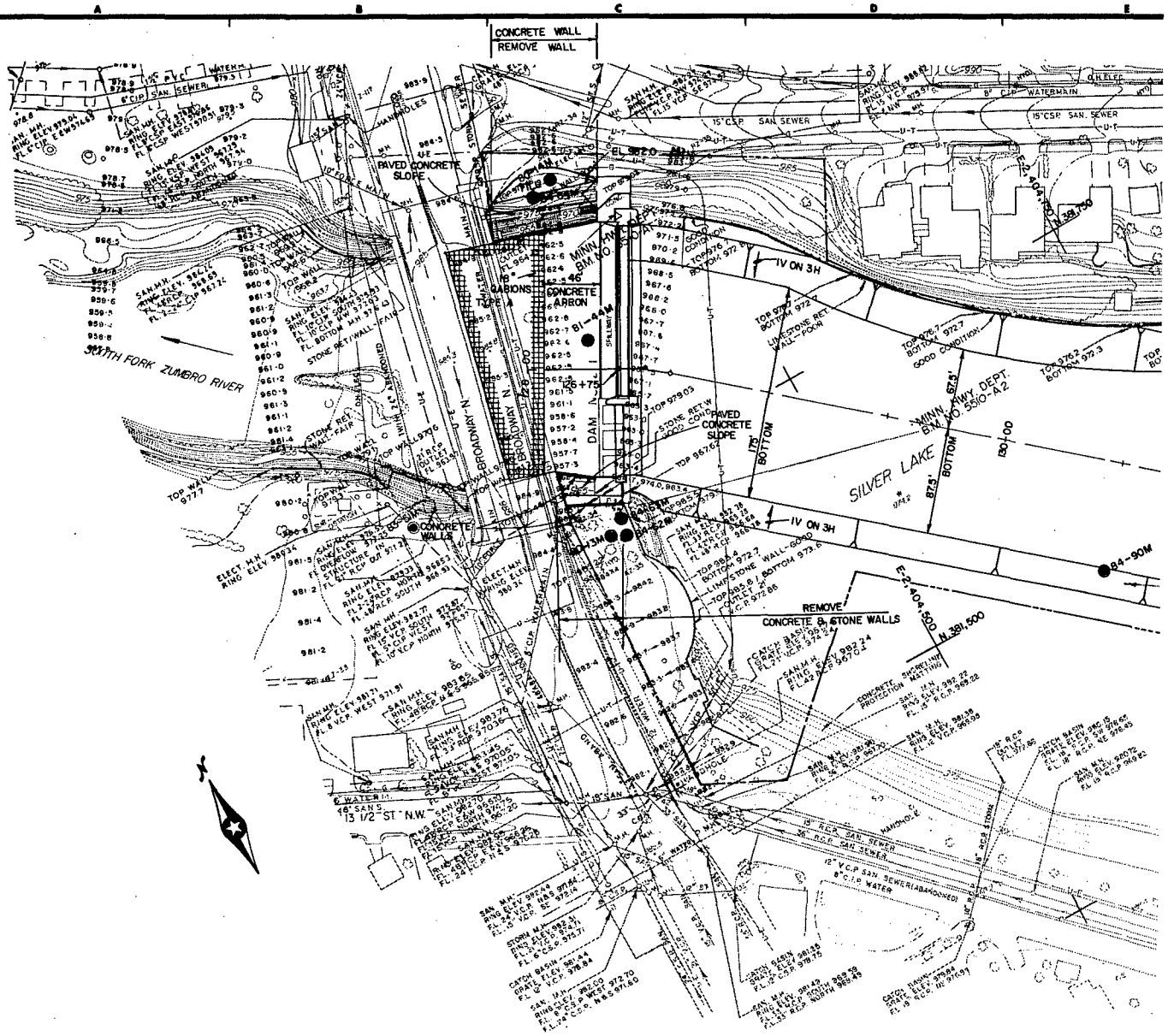
DESIGNED BY: D.O.
DRAWN BY: K.R.R.
CHECKED BY: D.O.
SUBMITTED BY:
APPROVED BY:

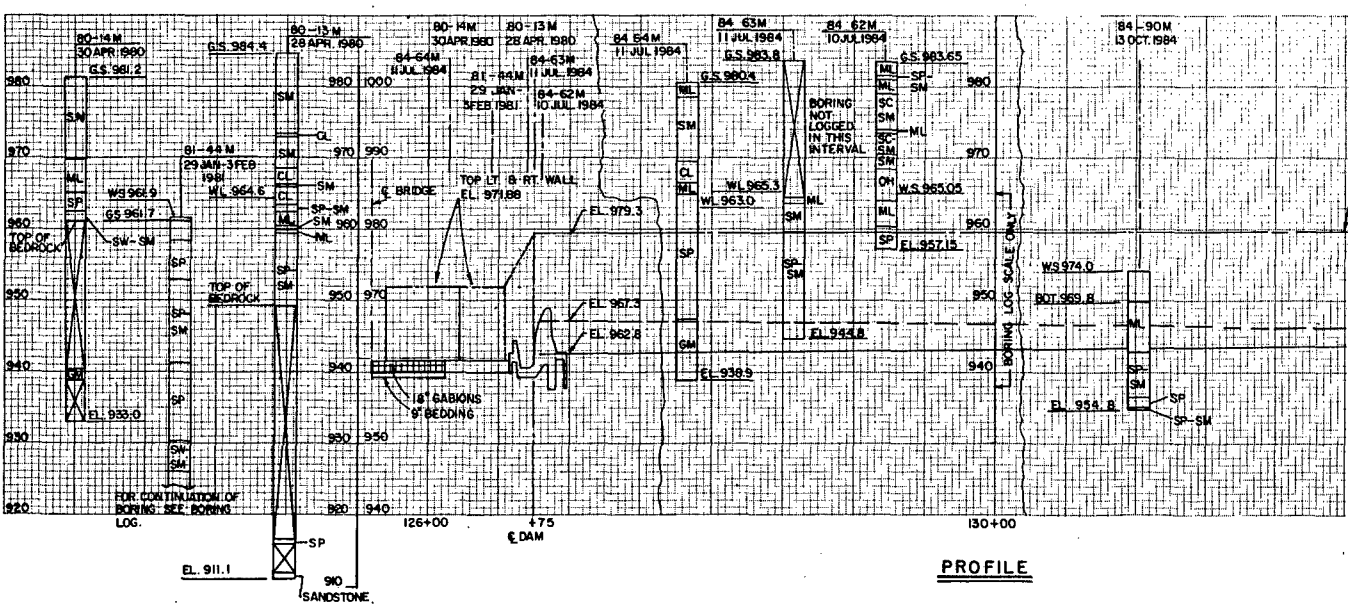
DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 18
TYPICAL SECTIONS
STA. 198+60 TO STA. 203+40 & STA. 1+95 TO STA. 6+15

DATE: APRIL 1988
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-64/4
SHEET 15 OF 51

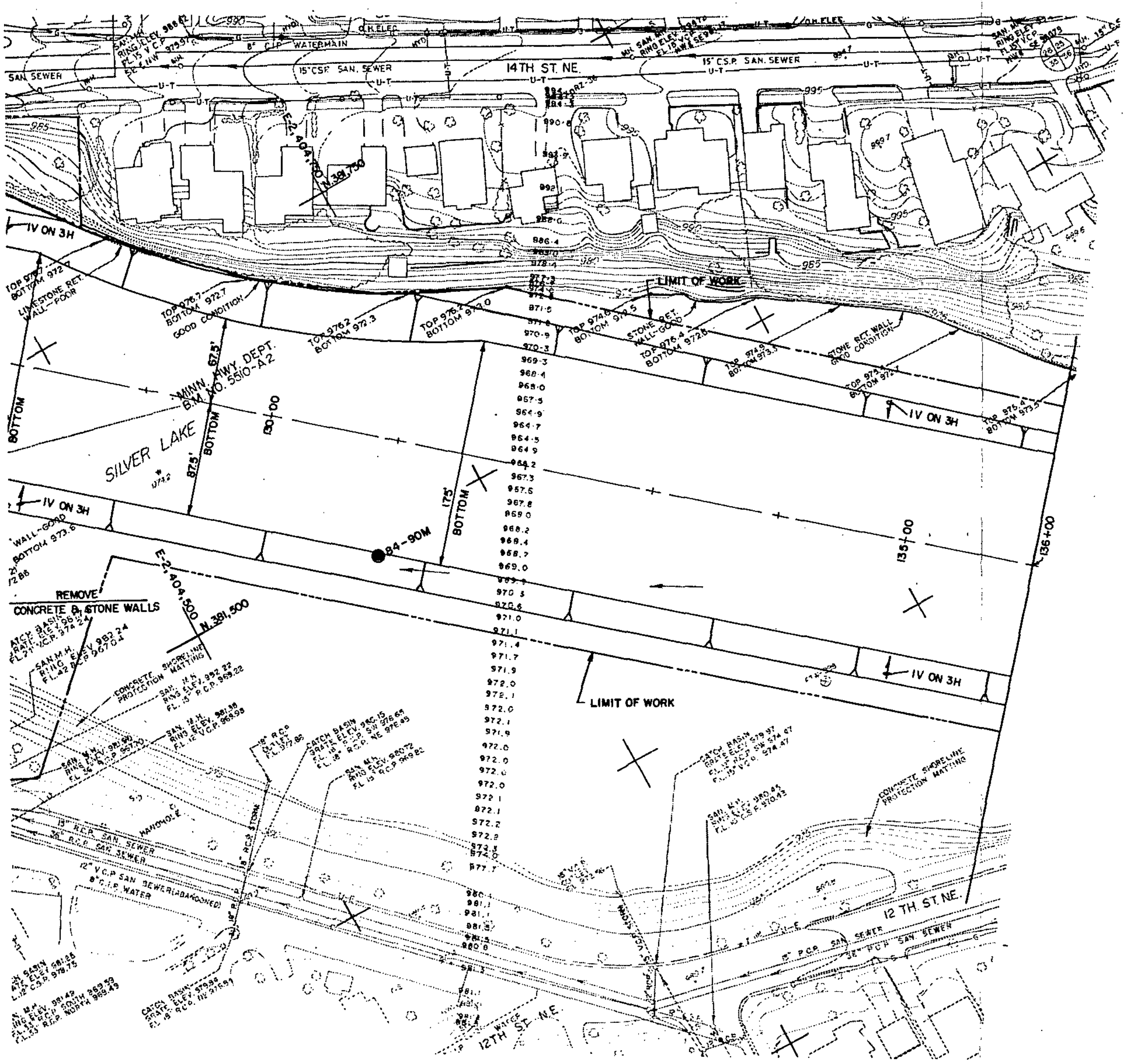
3

PLATE 15


CONCRETE WALL
REMOVE WALL
SOUTH FORK ZUMBRO RIVER
PAVED CONCRETE SLOPE
GABIONS TYPE A
CONCRETE APRON
DAM
BROADWAY N.
SILVER LAKE
MINN. HWY. DEPT. B.M. NO. 3510-A2
REMOVE CONCRETE & STONE WALLS
CONCRETE WALLS
13 1/2 ST. N.W.
E. 2,404,500
N. 389,700
N. 389,500
PLAN
50 0 50 100
SCALE IN FEET

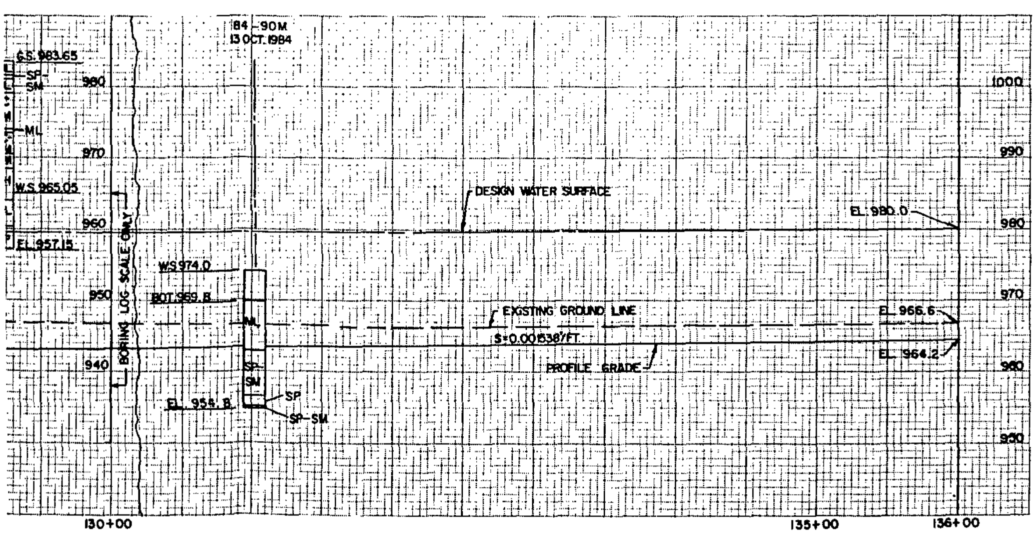

80-14M 30 APR 1980
80-15M 28 APR. 1980
80-14M 30APR 1980
80-13M 28 APR. 1980
84-64M 11 JUL 1984
84-63M 11 JUL 1984
84-62M 10 JUL 1984
84-90M 13 OCT. 1984
81-44M 29 JAN-3 FEB 1981
TOP OF BEDROCK
BORING NOT LOGGED IN THIS INTERVAL
TOP LT. & RT. WALL EL. 971.88
EL. 979.3
EL. 967.3
EL. 962.8
EL. 939.9
EL. 944.8
EL. 957.15
EL. 954.8
EL. 933.0
EL. 911.1
18' GABIONS 9' BEDDING
℄ BRIDGE
℄ DAM
126+00
+75
130+00
SANDSTONE
FOR CONTINUATION OF BORING SEE BORING LOG.
BORING LOG SCALE ONLY
PROFILE

D E F G H



PLAN

50 0 50 100
SCALE IN FEET



PROFILE

SYMBOL	DESCRIPTION

WHKS — Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

DE...
ST. P...

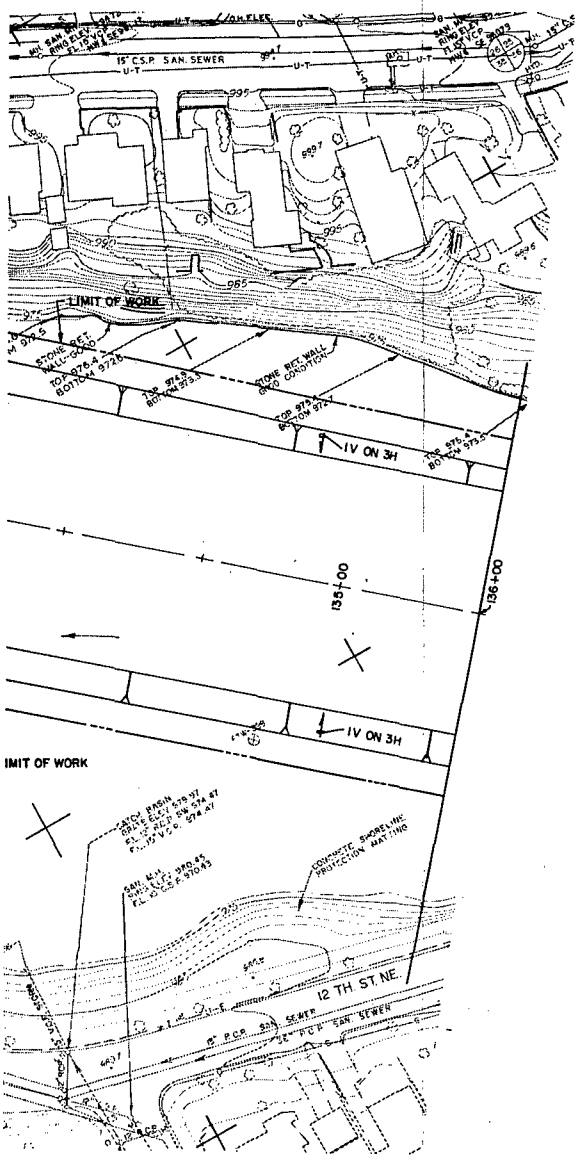
DESIGNED BY: G.E.F. / D.O.
DRAWN BY: G.E.N./K.R.R
CHECKED BY: D.J.P. / D.O.
SUBMITTED BY:
APPROVED BY:

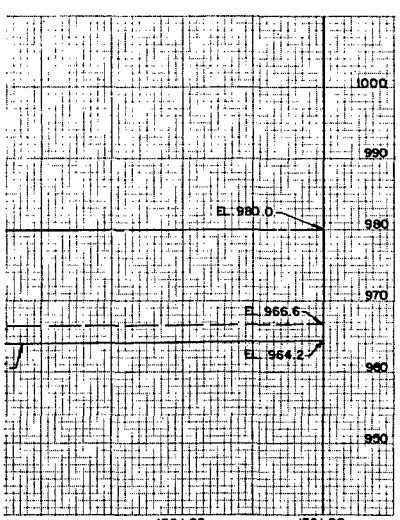
DESIGN MEMORANDUM NO. 2
FLOOD CONTROL SOL...
ROCHESTE...
STA...
PLAN AN...
126+00

SCALE
SHEET

D E F G

2





SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS = Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

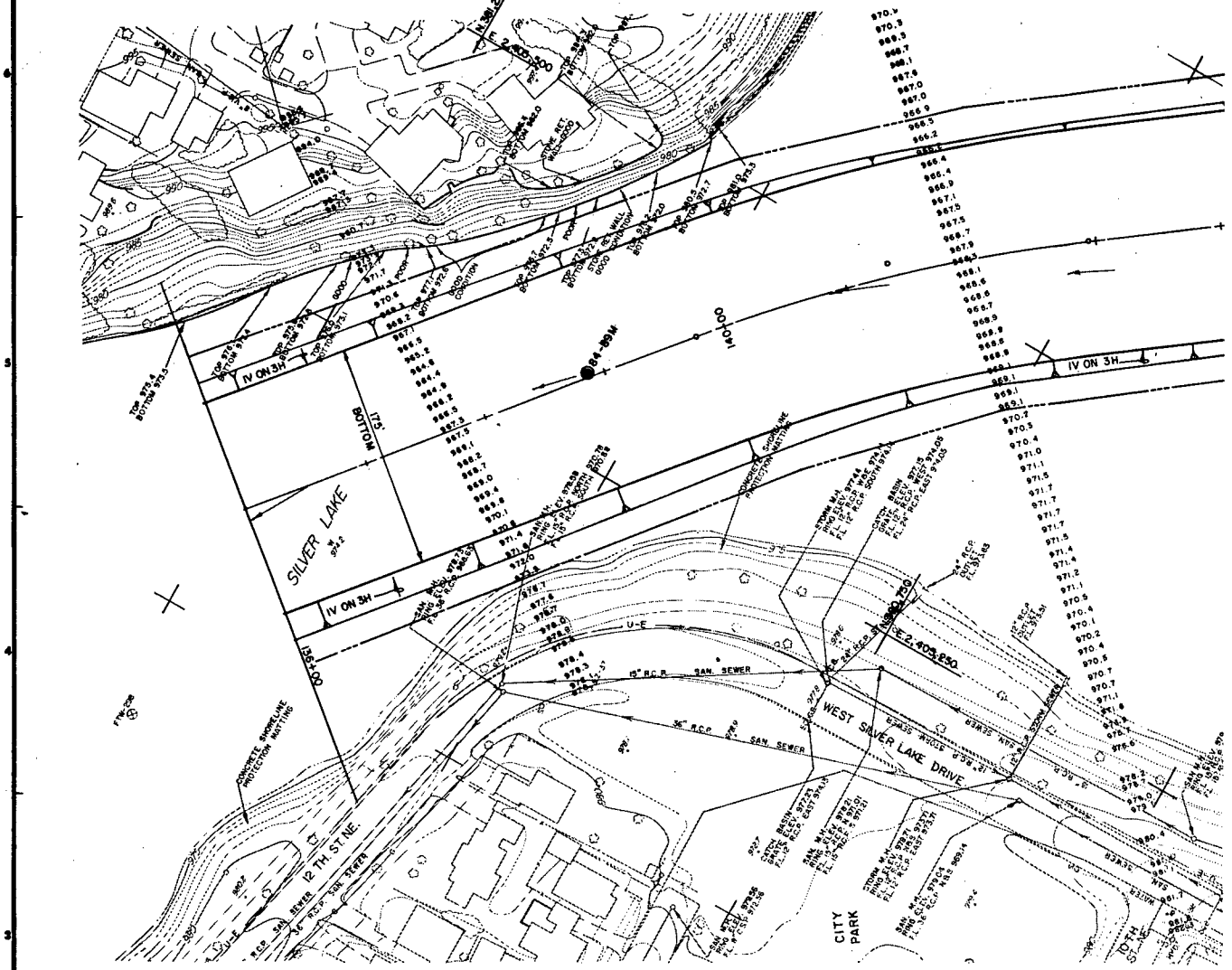
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: G.E.F. / D.Q.
DRAWN BY: G.E.N./K.R.R
CHECKED BY: D.J.P. / D.Q.
SUBMITTED BY: CHIEF, ED-D BRANCH
CHIEF, ED-H BRANCH

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
PLAN AND PROFILE
126+00 TO 136+00

APPROVED BY: CHIEF, ENGR. DIVISION
DATE: APRIL 1988
SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER: M30-R-64/5
SHEET 16 OF 81

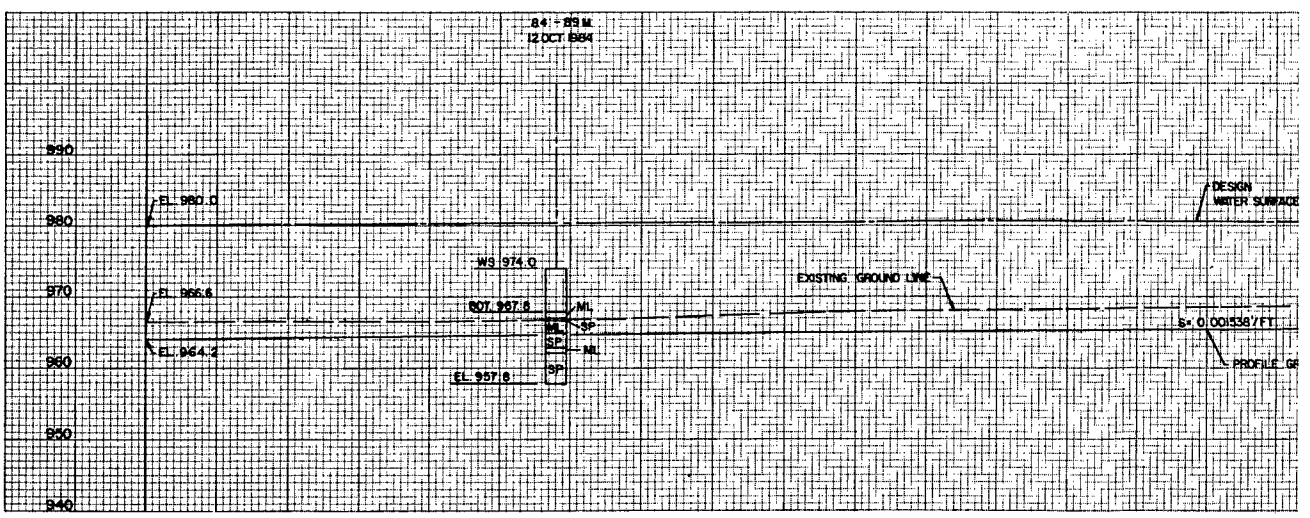
PLATE 16



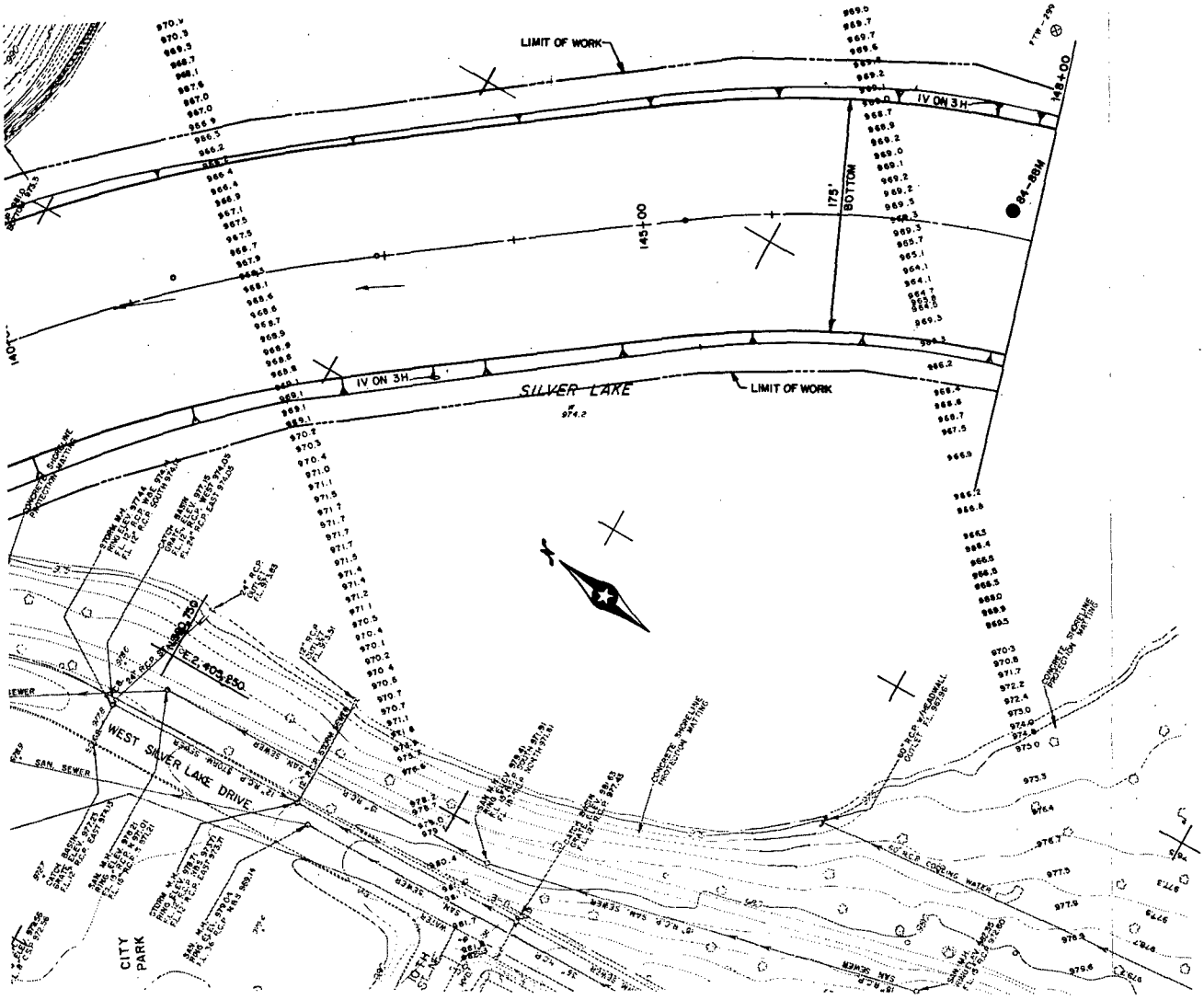
PLAN

50 0 50 100

SCALE IN FEET



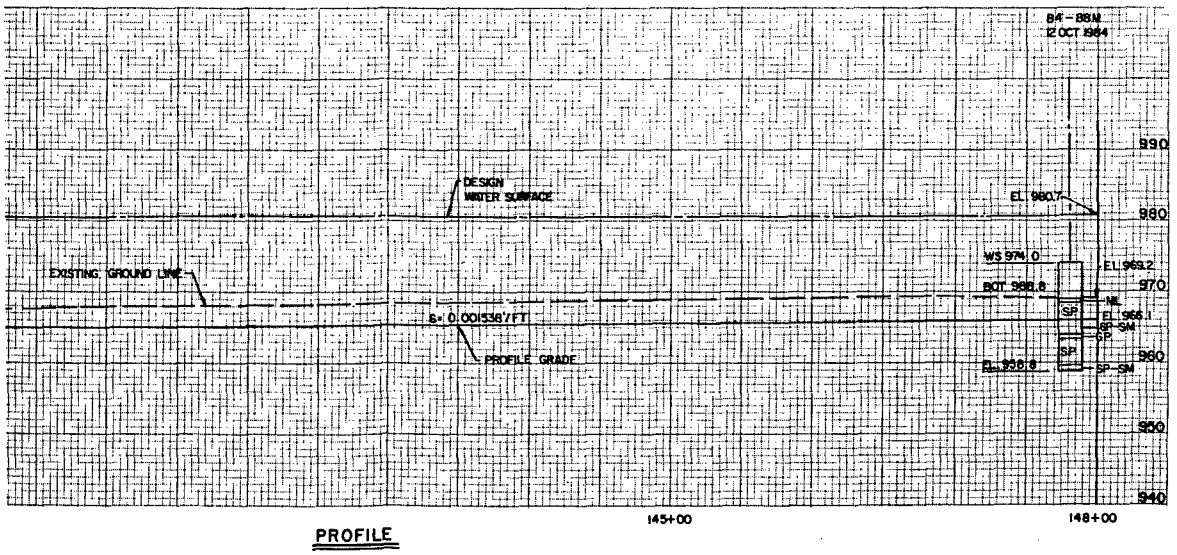
PROFILE



PLAN

50 0 50 100

SCALE IN FEET

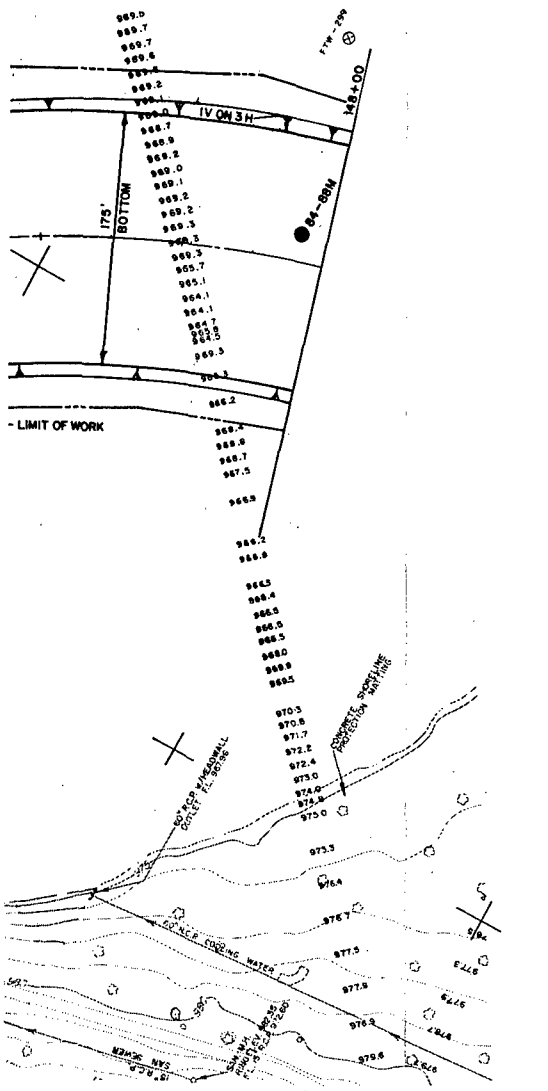


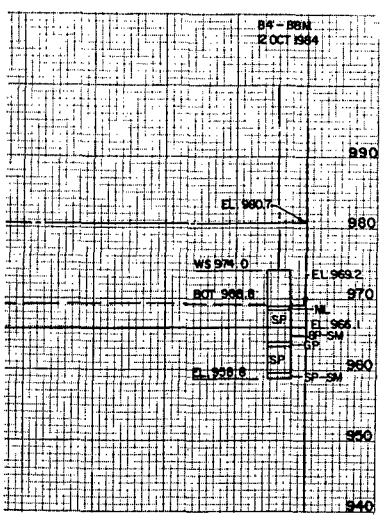
PROFILE

SYMBOL	

WHKS – Professional Engineers &
Mason City, Ia. – Rochester, Mn. – D

DESIGNED BY:	G.E.F. / D.O.
DRAWN BY:	G.E.N./K.R.R
CHECKED BY:	O.J.P./D.O.
SUBMITTED BY:	DESIGN
	APPROV





SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

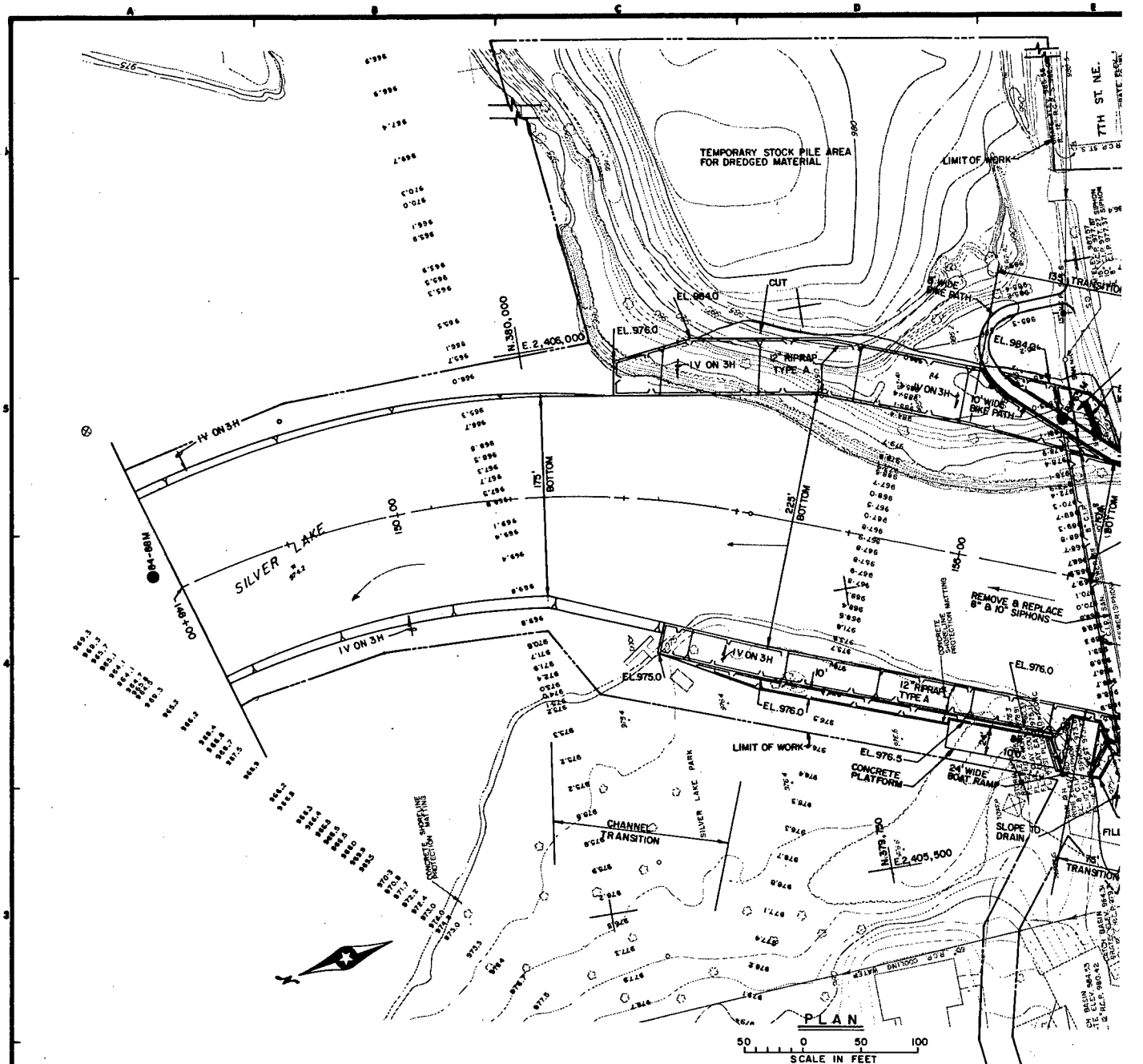
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

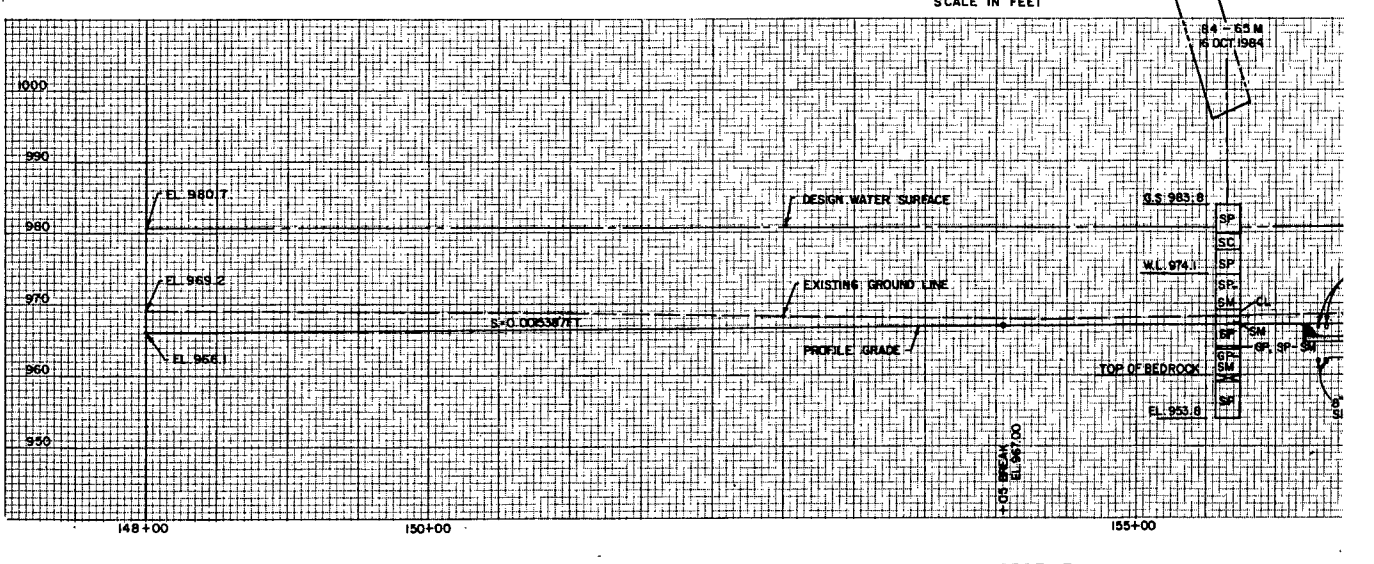
DESIGNED BY: G.E.F / D.O.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.P./D.O.
SUBMITTED BY:
APPROVED BY:

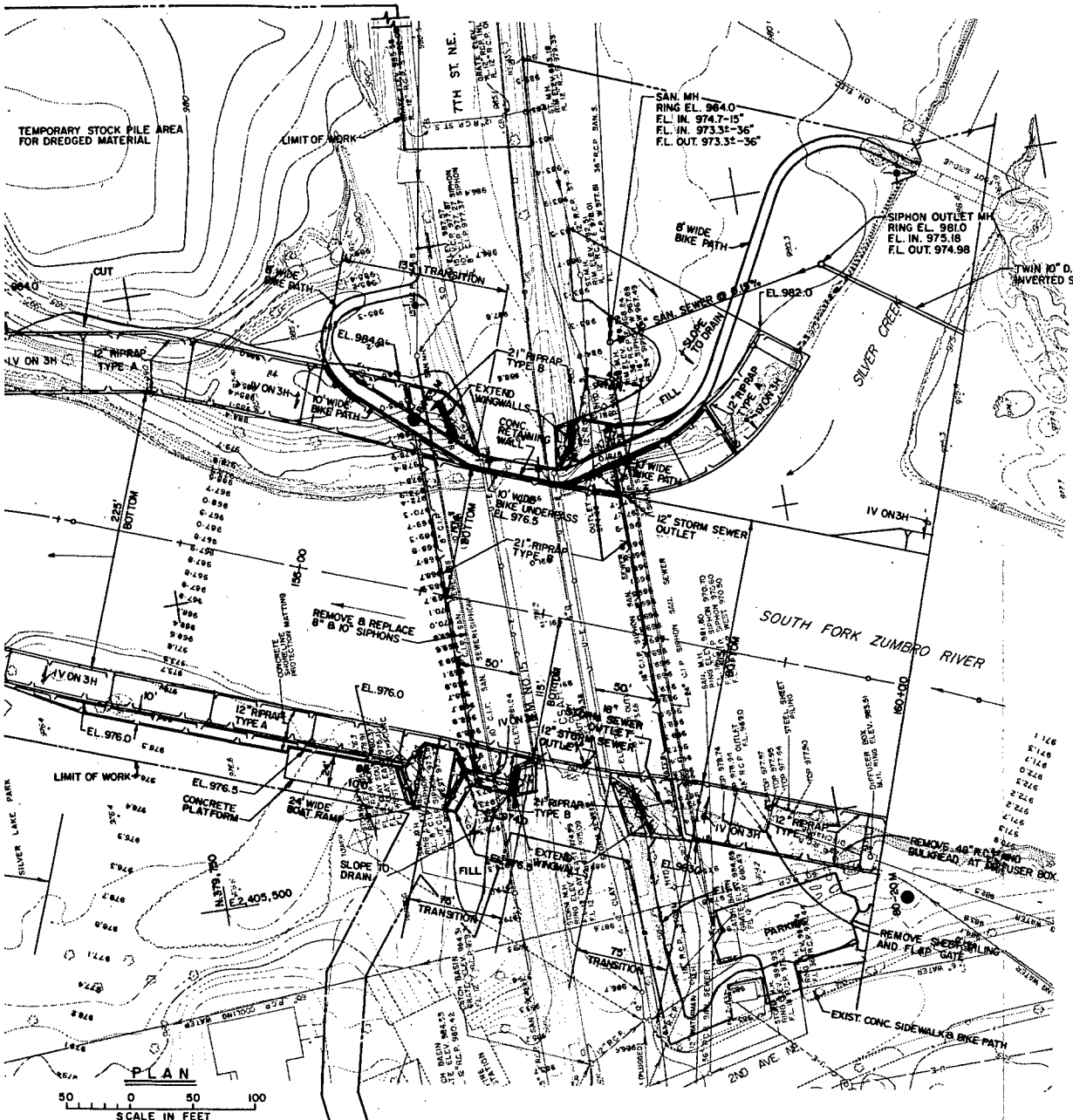
DESIGN MEMORANDUM NO. 2 — FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
PLAN AND PROFILE
136+00 TO 148+00

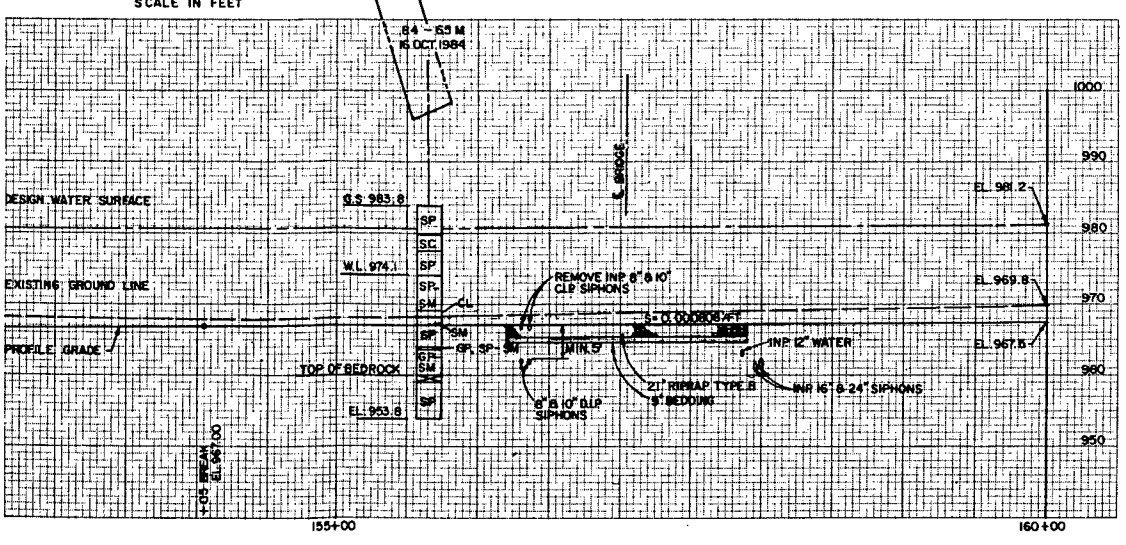
DATE: APRIL 1968
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-64/6
SHEET 17 OF 86

PLATE 17


TEMPORARY STOCK PILE AREA FOR DREDGED MATERIAL
LIMIT OF WORK
CUT
EL. 984.0
EL. 976.0
N. 380,000
E. 2,405,000
1V ON 3H
12" RIPRAP TYPE A
8' WIDE BIKE PATH
10' WIDE BIKE PATH
175' BOTTOM
225' BOTTOM
SILVER LAKE
84-98M
148+00
150+00
155+00
REMOVE & REPLACE 6" ø 10" SIPHONS
CONCRETE MATTING PROTECTION
EL. 975.0
EL. 976.5
CONCRETE PLATFORM
24' WIDE BOAT RAMP
CHANNEL TRANSITION
SILVER LAKE PARK
SLOPE TO DRAIN
N. 379,700
E. 2,405,500
75' TRANSITION
PLAN
50 0 50 100
SCALE IN FEET


84 - 65 M
15 OCT. 1984
1000
990
980
970
960
950
EL. 980.7
EL. 969.2
EL. 955.1
S=-0.00538'/'T
DESIGN WATER SURFACE
EXISTING GROUND LINE
PROFILE GRADE
TOP OF BEDROCK
EL. 953.8
W.S. 983.8
W.L. 974.1
SP
SC
SM
CL
GP
148+00
150+00
155+00
PROFILE



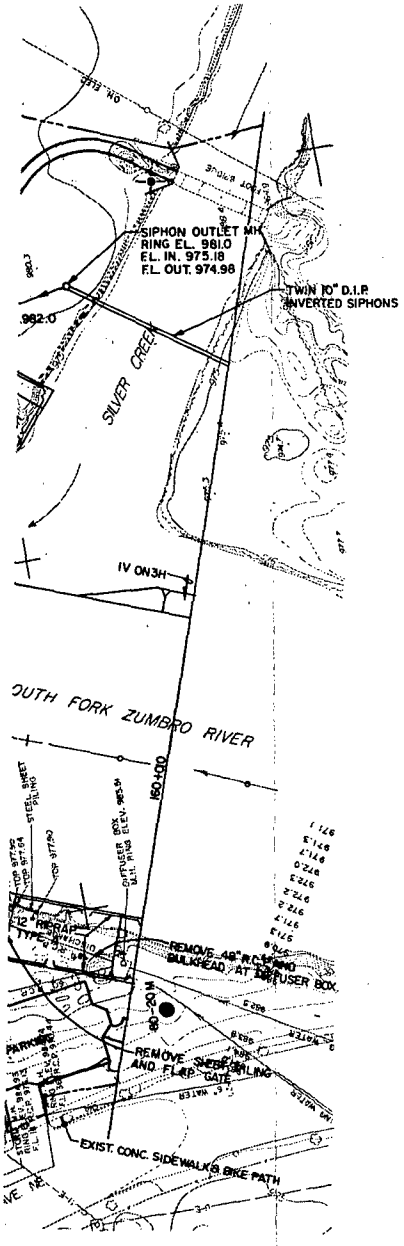


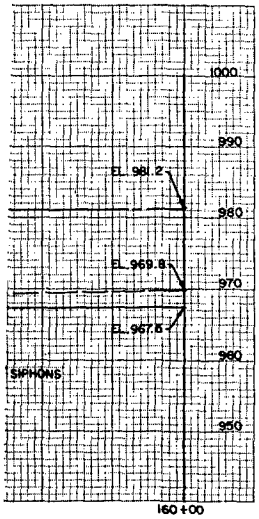
PROFILE

SYMBOL	DESCRIPTION

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

DESIGNED BY: G.E.F. / D.O.	DESIGN MEMORA FLOOD
DRAWN BY: G.E.N. / K.R.R.	
CHECKED BY: D.J.B. / D.O.	
SUBMITTED BY:	APPROVED BY:





LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

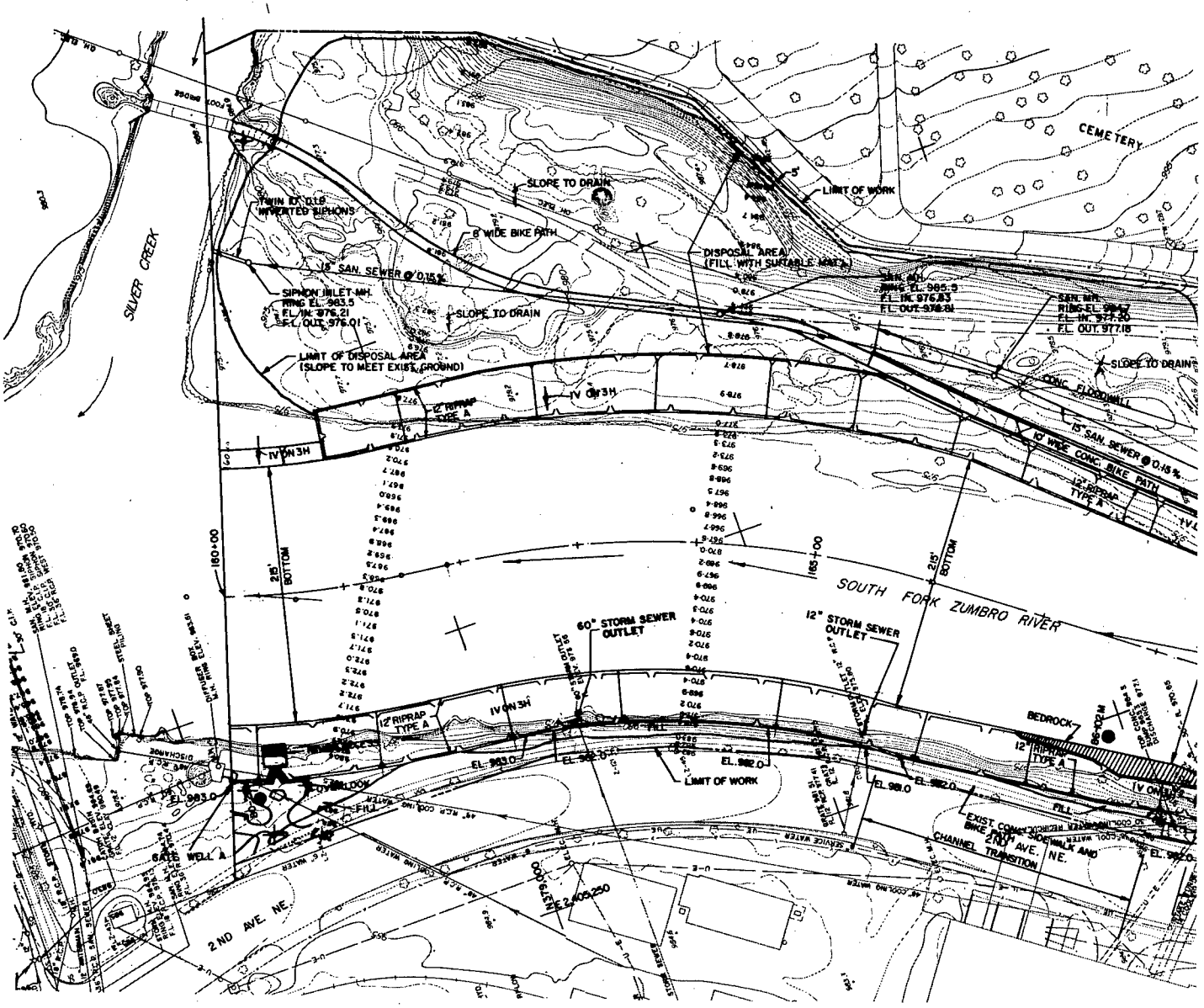
DESIGNED BY: G.E.F. / D.Q.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.P./ D.Q.
SUBMITTED BY: [signature] CHIEF, ENGR. BRANCH
[signature] CHIEF, DESIGN BRANCH

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
PLAN AND PROFILE
148+00 TO 160+00

APPROVED BY: [signature] CHIEF, ENGR. DIVISION
DATE: APRIL 1988

SCALE: AS SHOWN
DRAWING NUMBER
M30-R-64/7
SHEET 18 OF 68

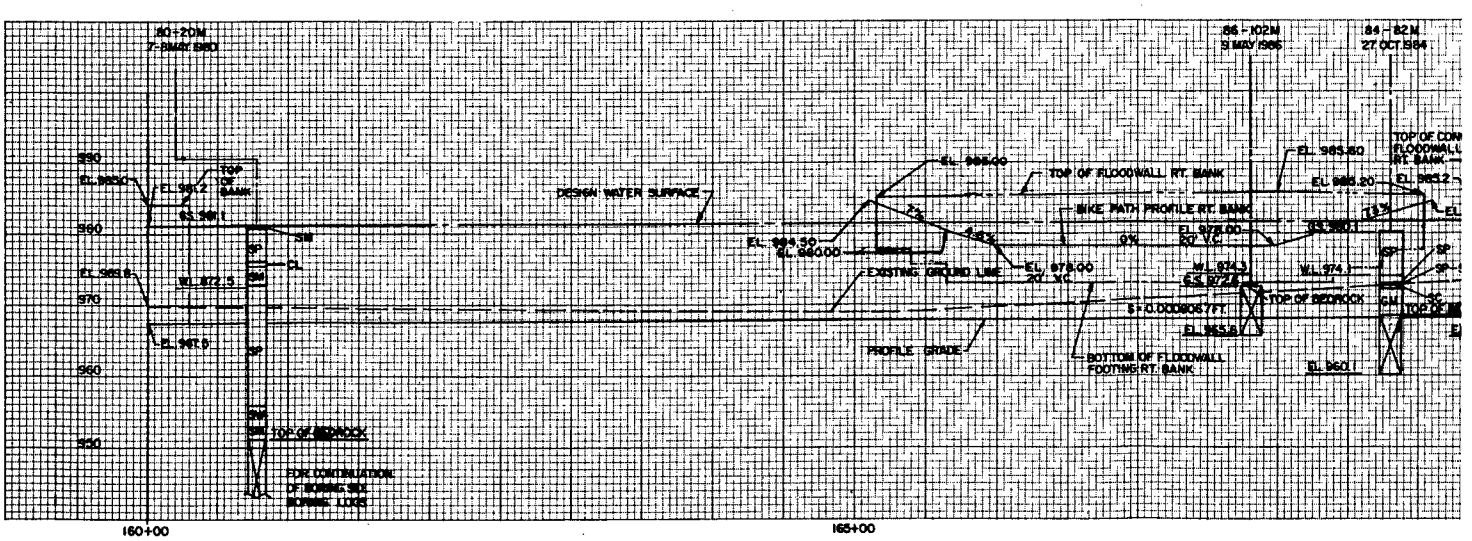
PLATE 18



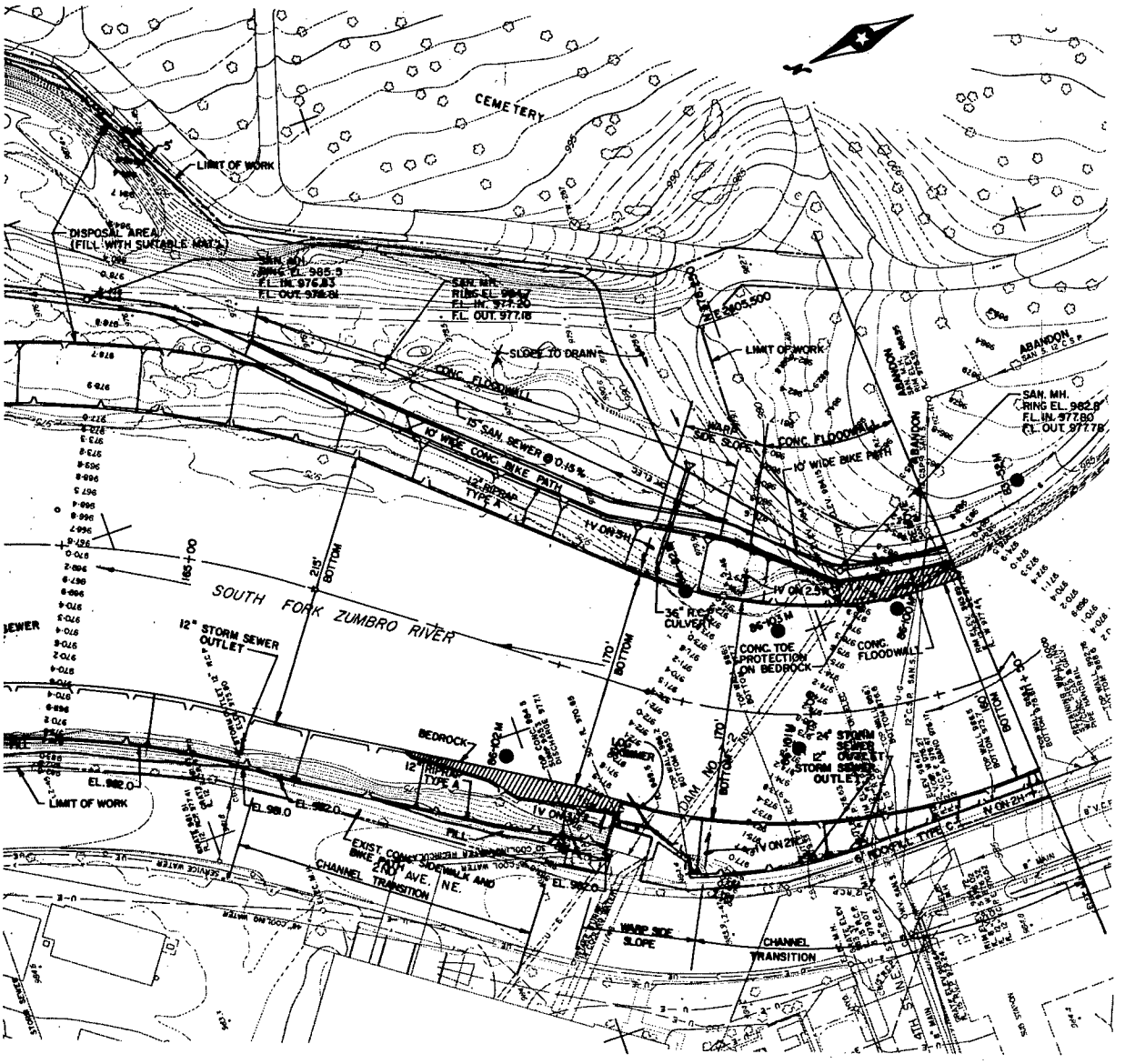
PLAN

50 0 50 100

SCALE IN FEET

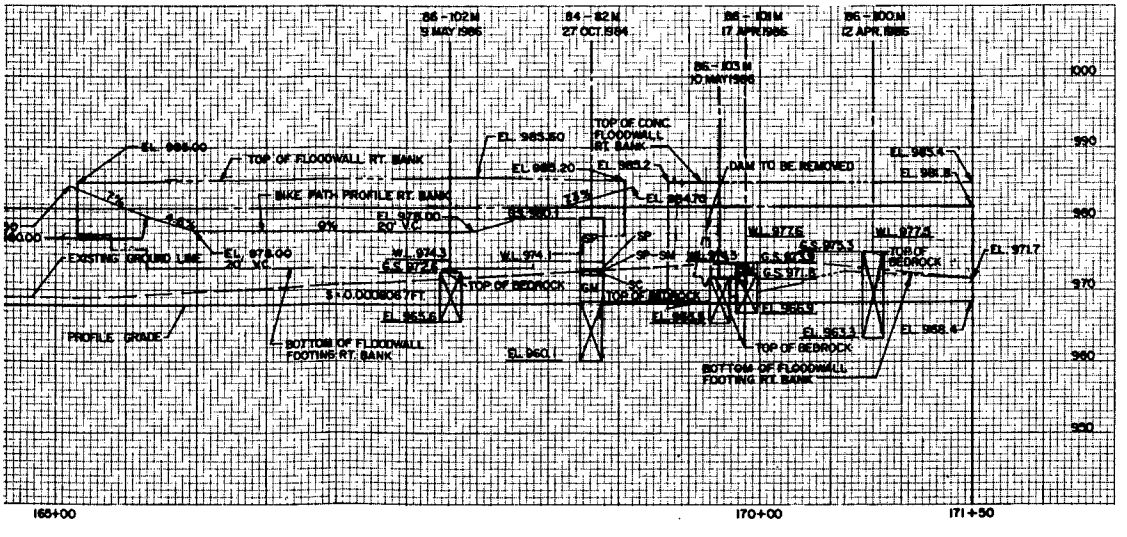


PROFILE



PLAN

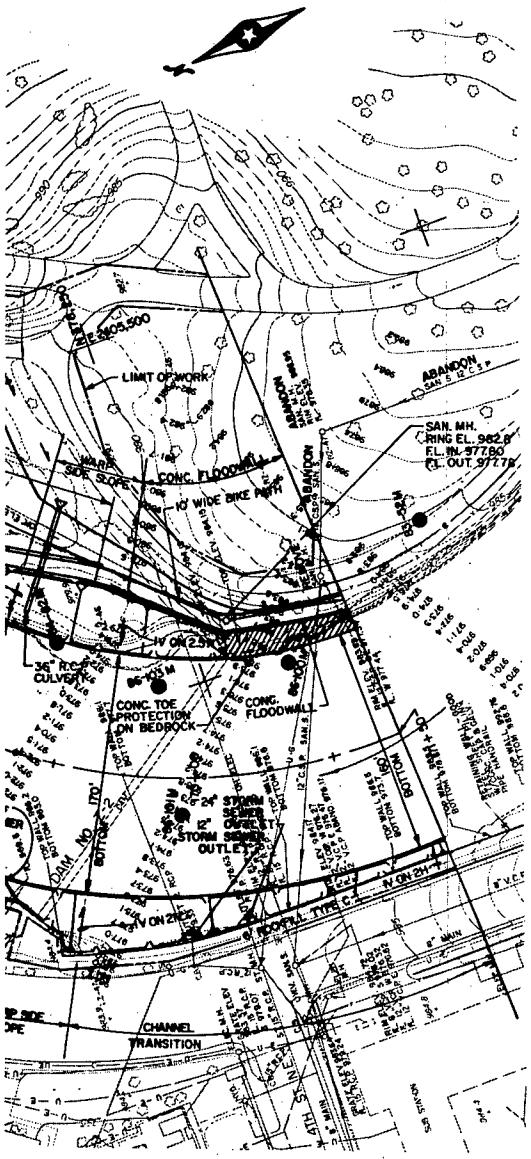
50 0 50 100
SCALE IN FEET

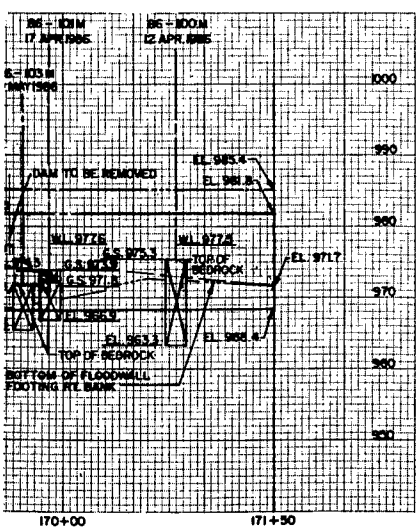


PROFILE

SYMBOL	DESCR
WHKS – Professional Engineers & Planners Mason City, Ia. – Rochester, Mn. – Dubuque, Ia	
DESIGNED BY: G.E.F./D.O.	DESIGN MEMOR FLOOD
DRAWN BY: G.E.N./K.R.R.	
CHECKED BY: D.J.P./D.O.	
SUBMITTED BY:	APPROVED BY:

SAFED DAYS





LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Minn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: G.E.F./D.O.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.P./D.O.

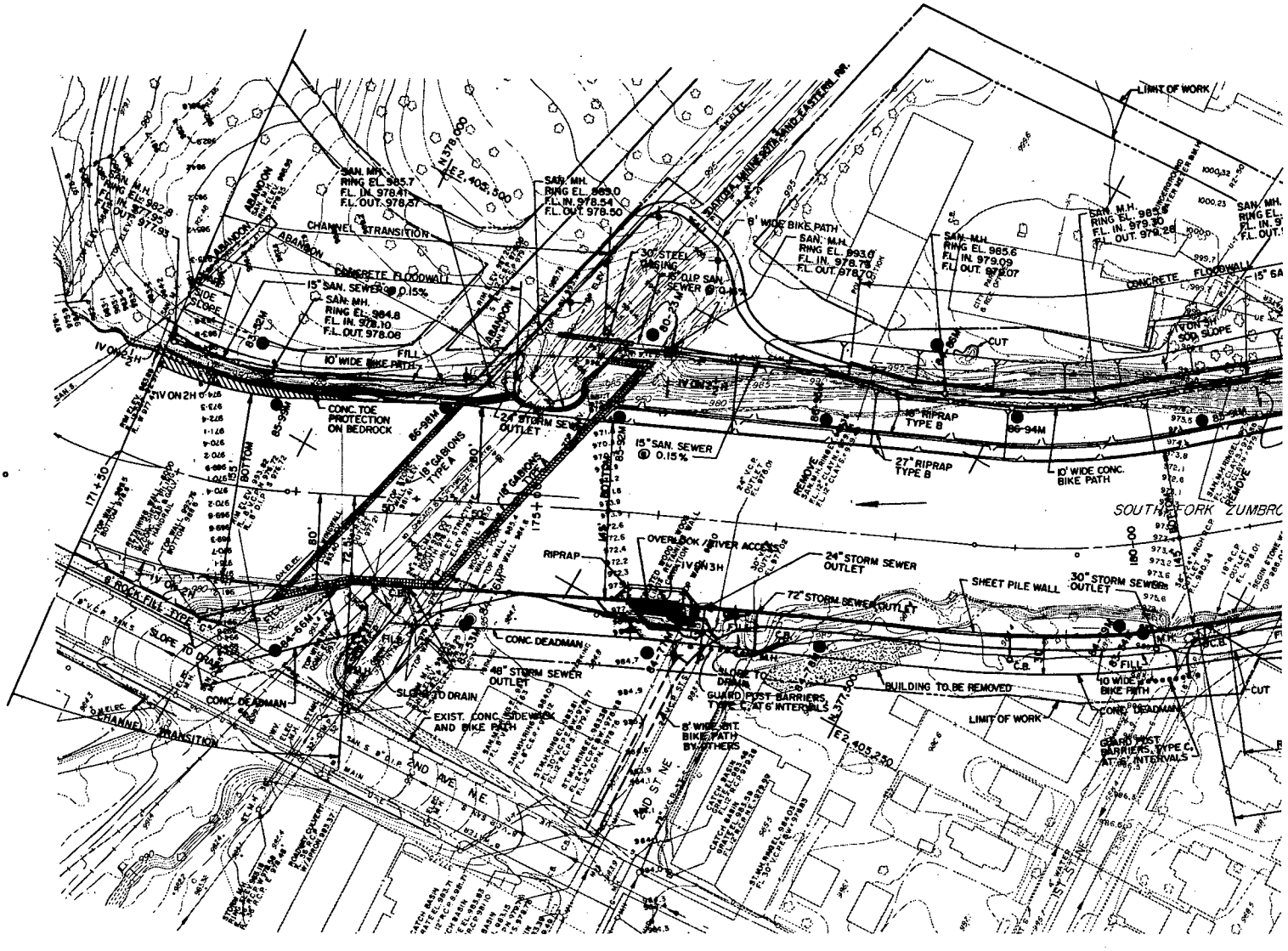
DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
PLAN AND PROFILE
160+00 TO 171+50

APPROVED BY: Robert L. Pratt
DATE: APRIL 1968

SCALE: AS SHOWN
DRAWING NUMBER: M30-R-64/8
SHEET 19 OF 51

PLATE 19

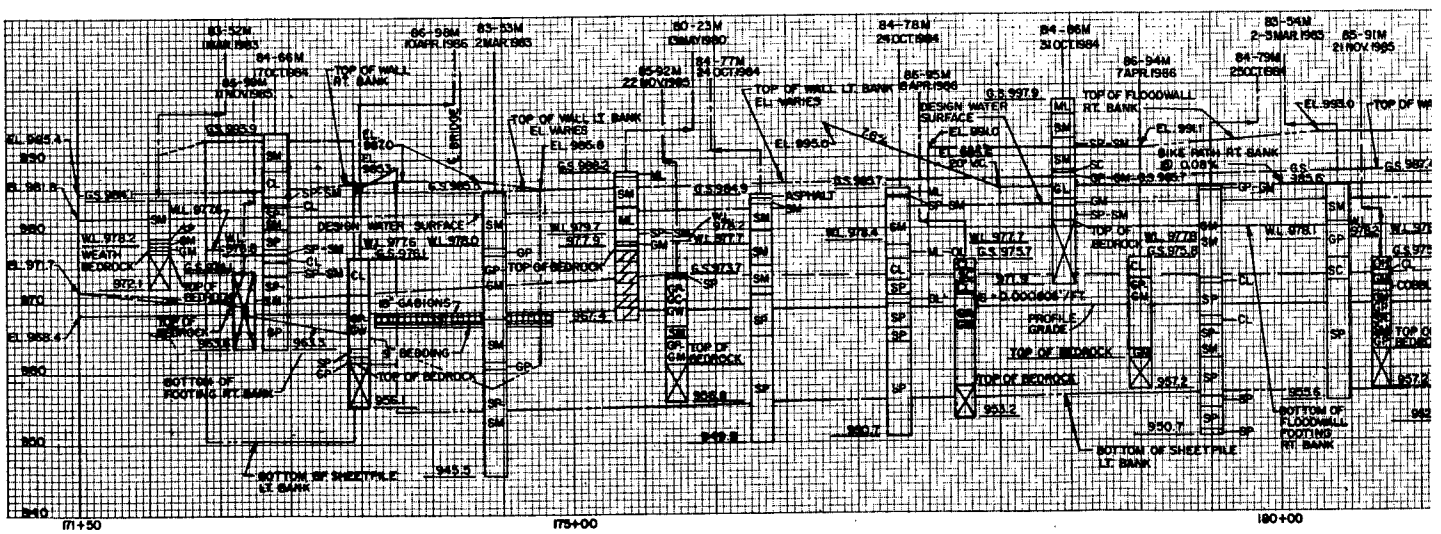
3



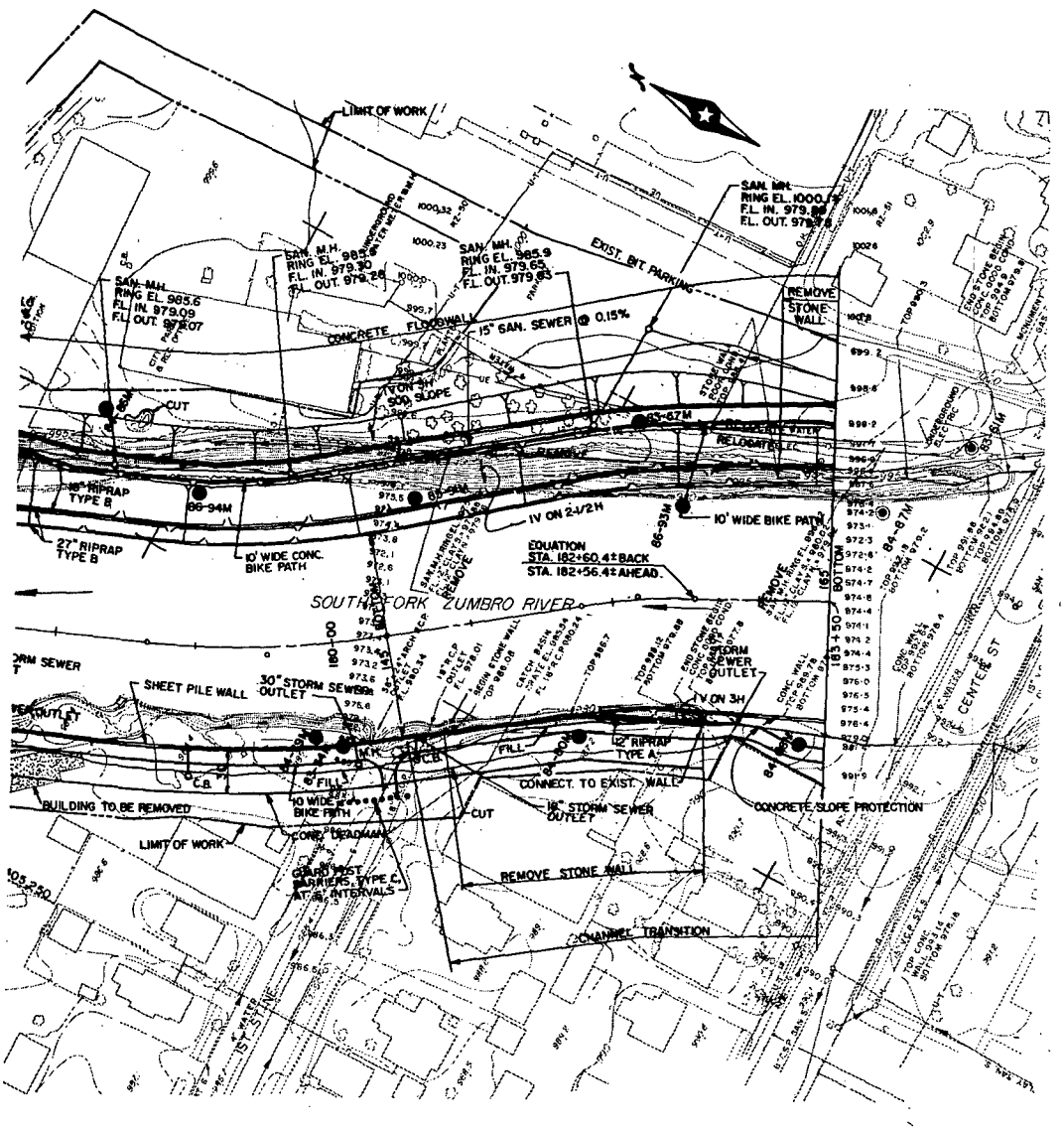
PLAN

50 0 50 100

SCALE IN FEET



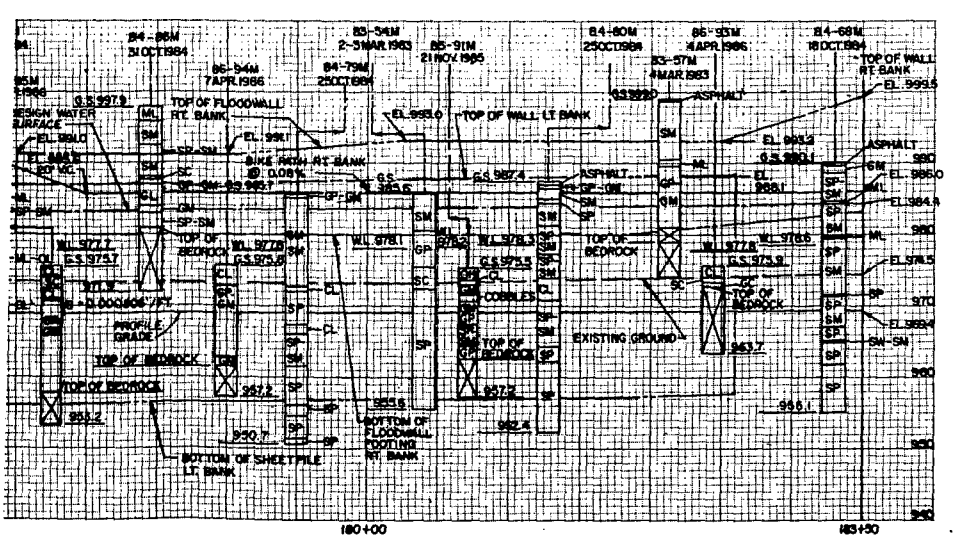
PROFILE



PLAN

50 0 50 100

SCALE IN FEET



ROFILE

LIGHTING LOCATIONS

SYMBOL	DESCRIPTION

WHKS - Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

DEPARTMENT (ST. PAUL DISTRICT, C ST. PAUL, M

DESIGNED BY: G.E.F./D.D.
DRAWN BY: G.E.M./K.R.R.
CHECKED BY: D.J.P./D.D.
SUBMITTED BY:
APPROVED BY:

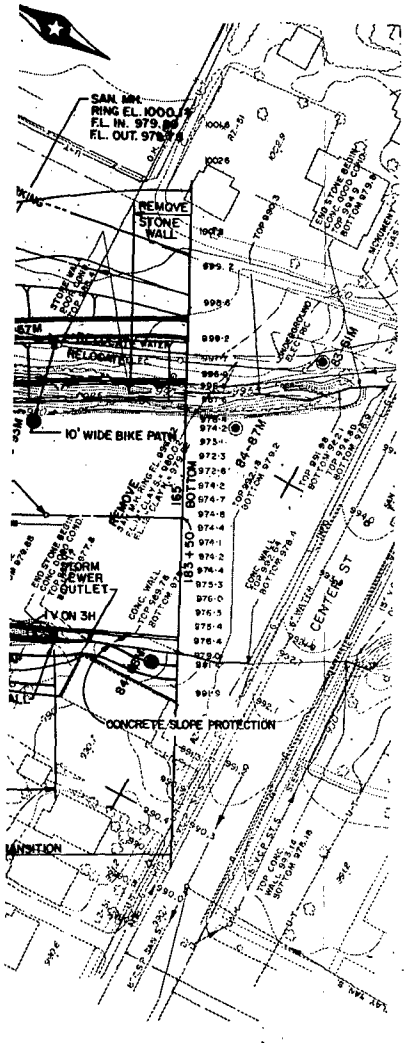
DESIGN MEMORANDUM NO. 2
FLOOD CONTROL SOUTH FORK Z
ROCHESTER, MINNES
STAGE 1B
PLAN AND PROF
171+50 TO 183+5

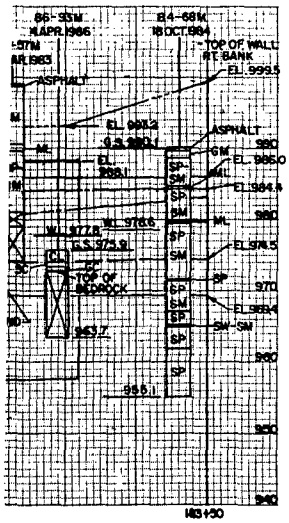
DA
APPR

SCALE AS SHOWN
DRAWI
M30
SHEET 20 OF (

SAFETY DAYS

2





LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS - Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

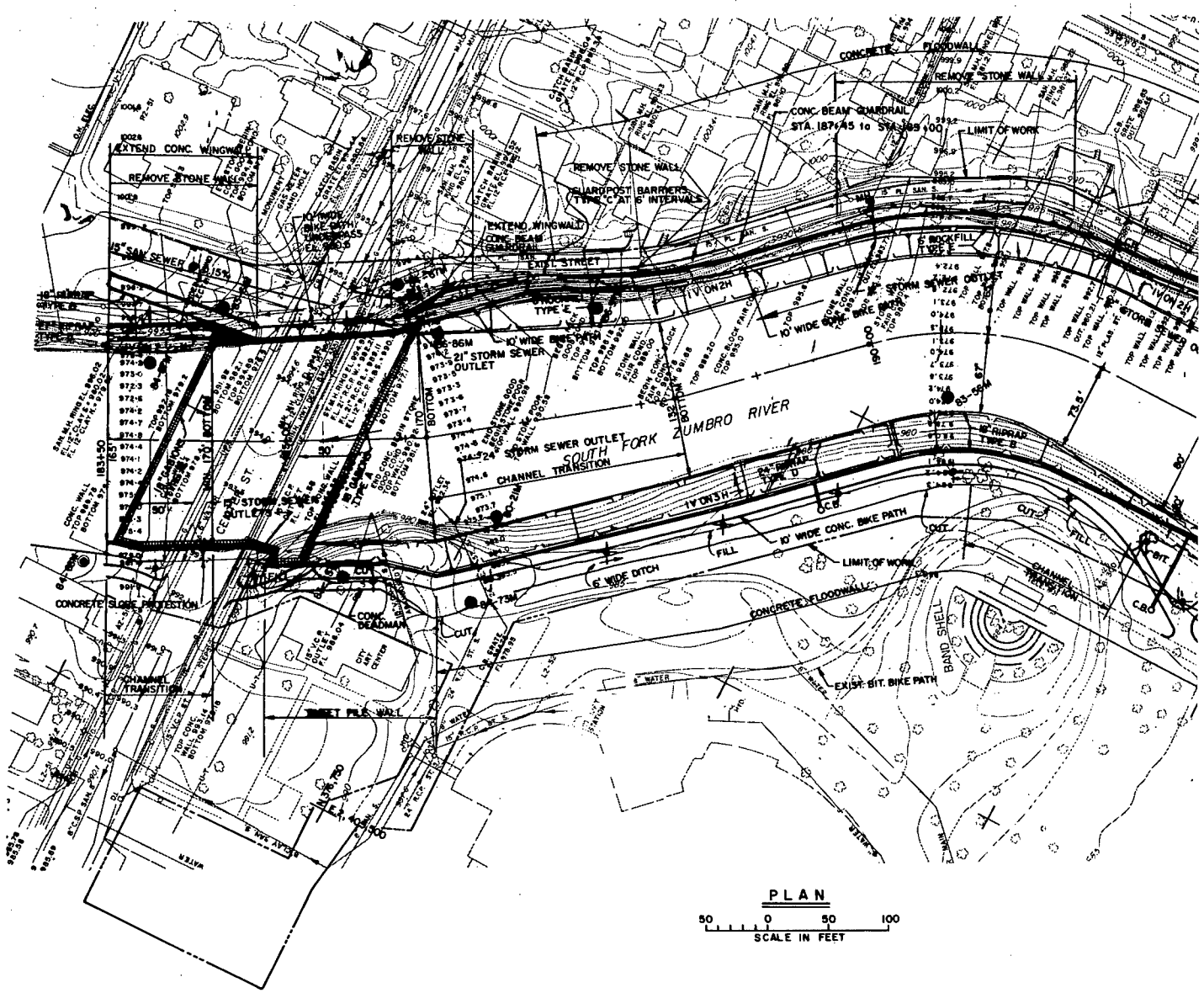
DESIGNED BY: G.E.F./D.O.
DRAWN BY: G.E.M./K.R.R.
CHECKED BY: D.J.P./D.O.
SUBMITTED BY:
APPROVED BY:

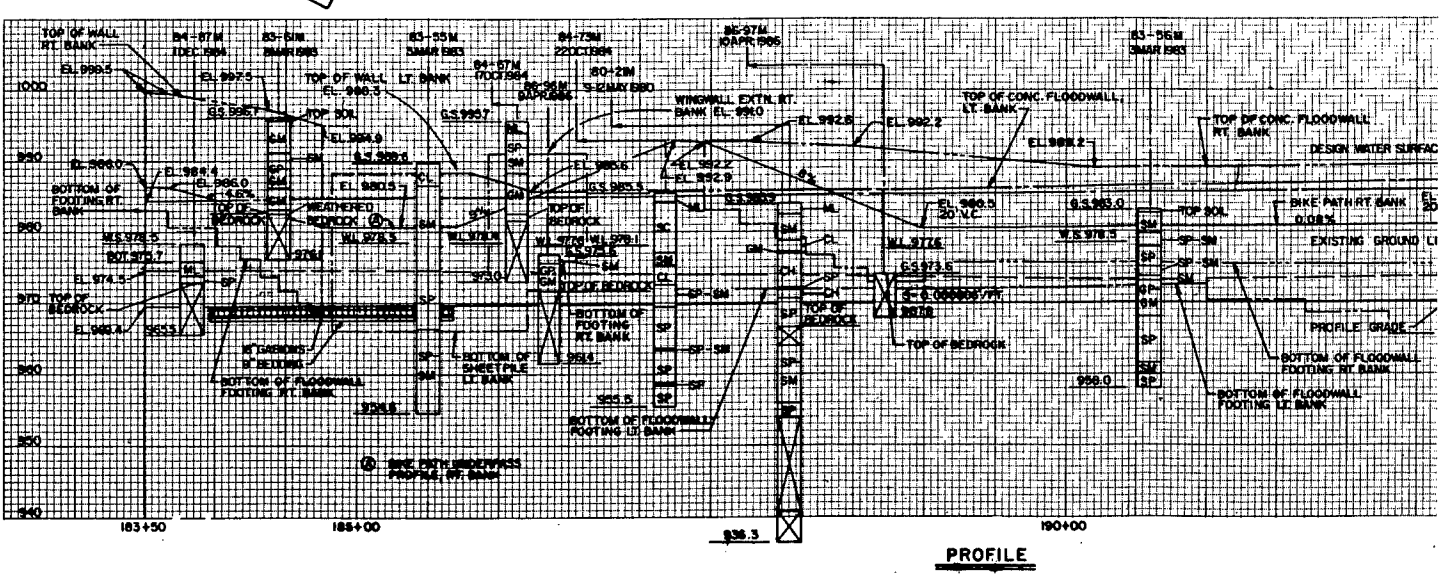
DESIGN MEMORANDUM NO.2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
PLAN AND PROFILE
171+50 TO 183+50

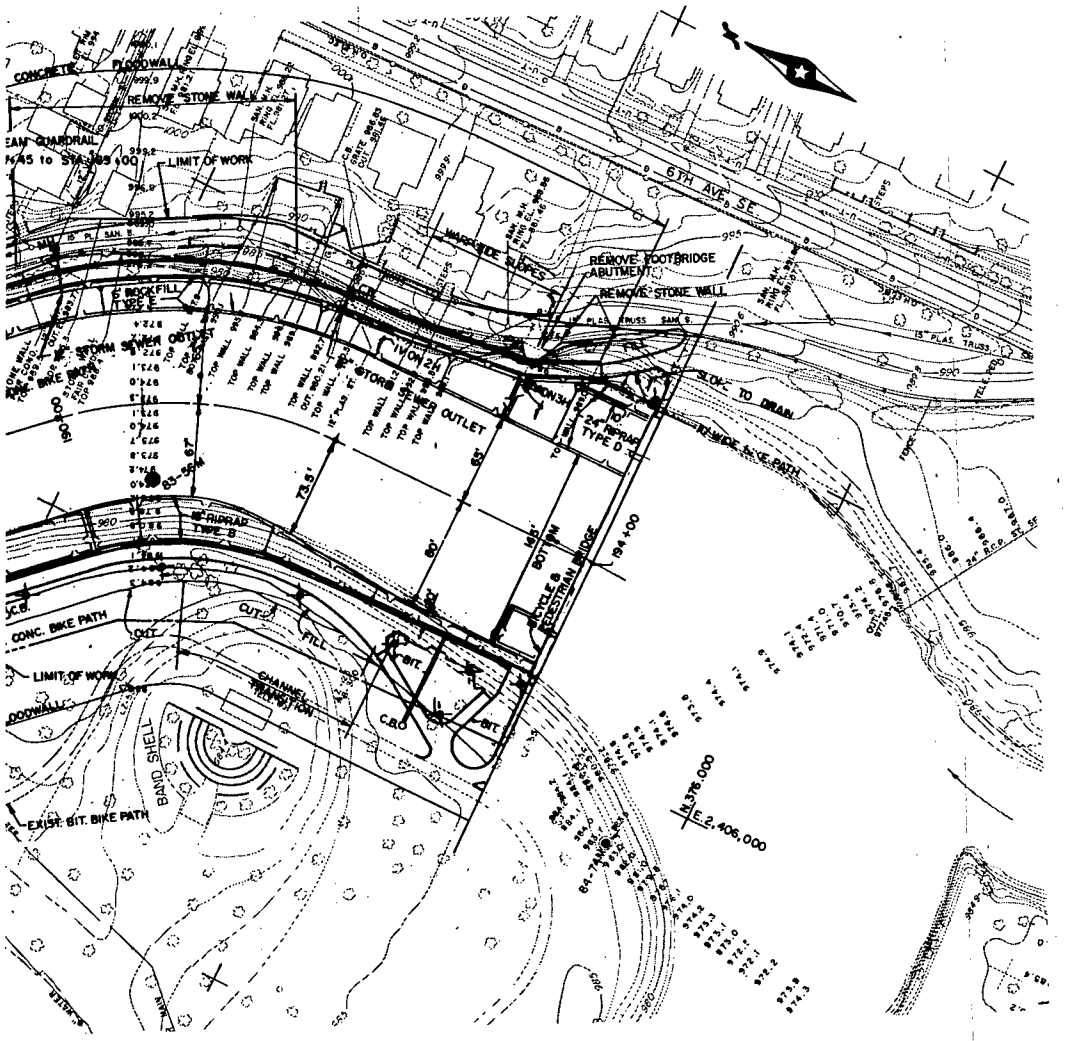
DATE: APRIL 1986
SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER: M30-R-6479
SHEET 20 OF 24

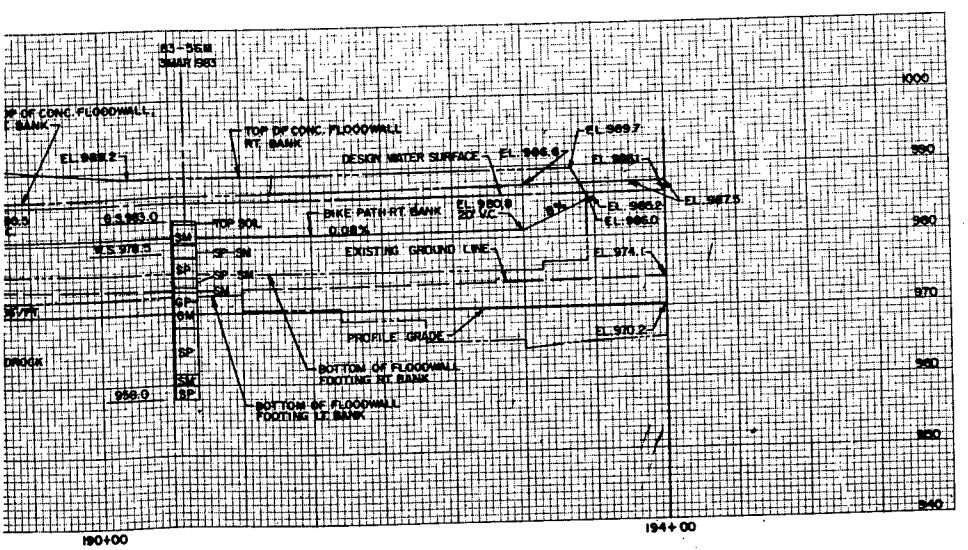
PLATE 20

3


ZUMBRO RIVER
SOUTH FORK
CHANNEL TRANSITION
CONCRETE FLOODWALL
REMOVE STONE WALL
CONC. BEAM GUARDRAIL
GUARDPOST BARRIERS TYPE 'C' AT 6' INTERVALS
LIMIT OF WORK
10' WIDE CONC. BIKE PATH
EXIST. BIT. BIKE PATH
6' WIDE DITCH
CONCRETE SLOPE PROTECTION
SHEET PILE WALL
CONC. DEADMAN
EXTEND CONC. WINGWALL
EXTEND WINGWALL
EXIST. STREET
21" STORM SEWER OUTLET
CEDAR ST.
BAND SHELL
PLAN
50 0 50 100
SCALE IN FEET


PROFILE
183+50
185+00
190+00
TOP OF WALL RT. BANK
TOP OF WALL LT. BANK
BOTTOM OF FOOTING RT. BANK
BOTTOM OF SHEETPILE LT. BANK
BOTTOM OF FLOODWALL FOOTING RT. BANK
BOTTOM OF FLOODWALL FOOTING LT. BANK
WINGWALL EXTN. RT. BANK
TOP OF CONC. FLOODWALL LT. BANK
TOP OF CONC. FLOODWALL RT. BANK
BIKE PATH RT. BANK
EXISTING GROUND
PROFILE GRADE
TOP OF BEDROCK
WEATHERED BEDROCK
TOP SOIL





ROFILE

LIGHTING LOCATIONS

SYMBOL	DESCRIPTION

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

DEPARTMENT (
ST. PAUL DISTRICT, C
ST. PAUL, M

DESIGNED BY: G.E.F. D.O.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.P./D.O.
SUBMITTED BY:

DESIGN MEMORANDUM NO. 2
FLOOD CONTROL SOUTH FORK Z
ROCHESTER, MINNES
STAGE IB
PLAN AND PROFI
183+50 TO 194+0

APPROVED BY:

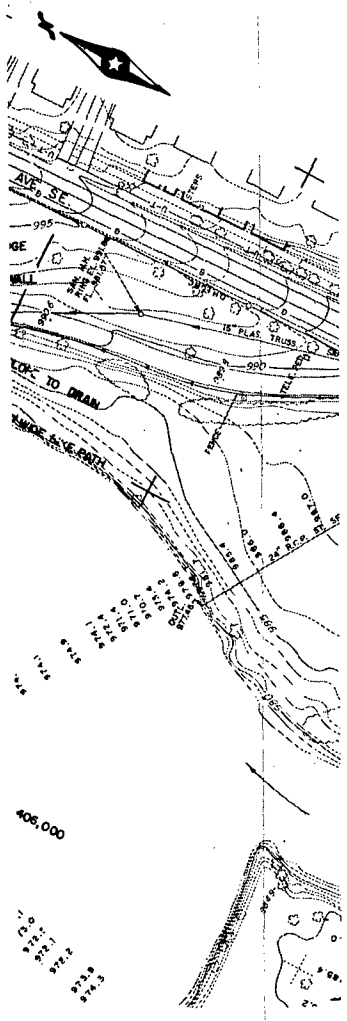
DA
APRIL

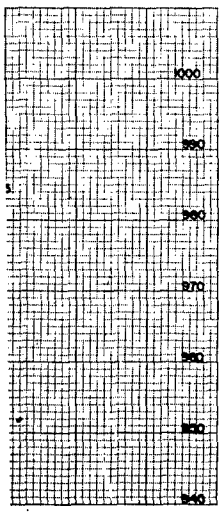
SCALE AS SHOWN

DRAWI
M30-

SHEET 21 OF

SAFETY PAYS





LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: G.E.F.
D.O.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.P./ D.O.
SUBMITTED BY:

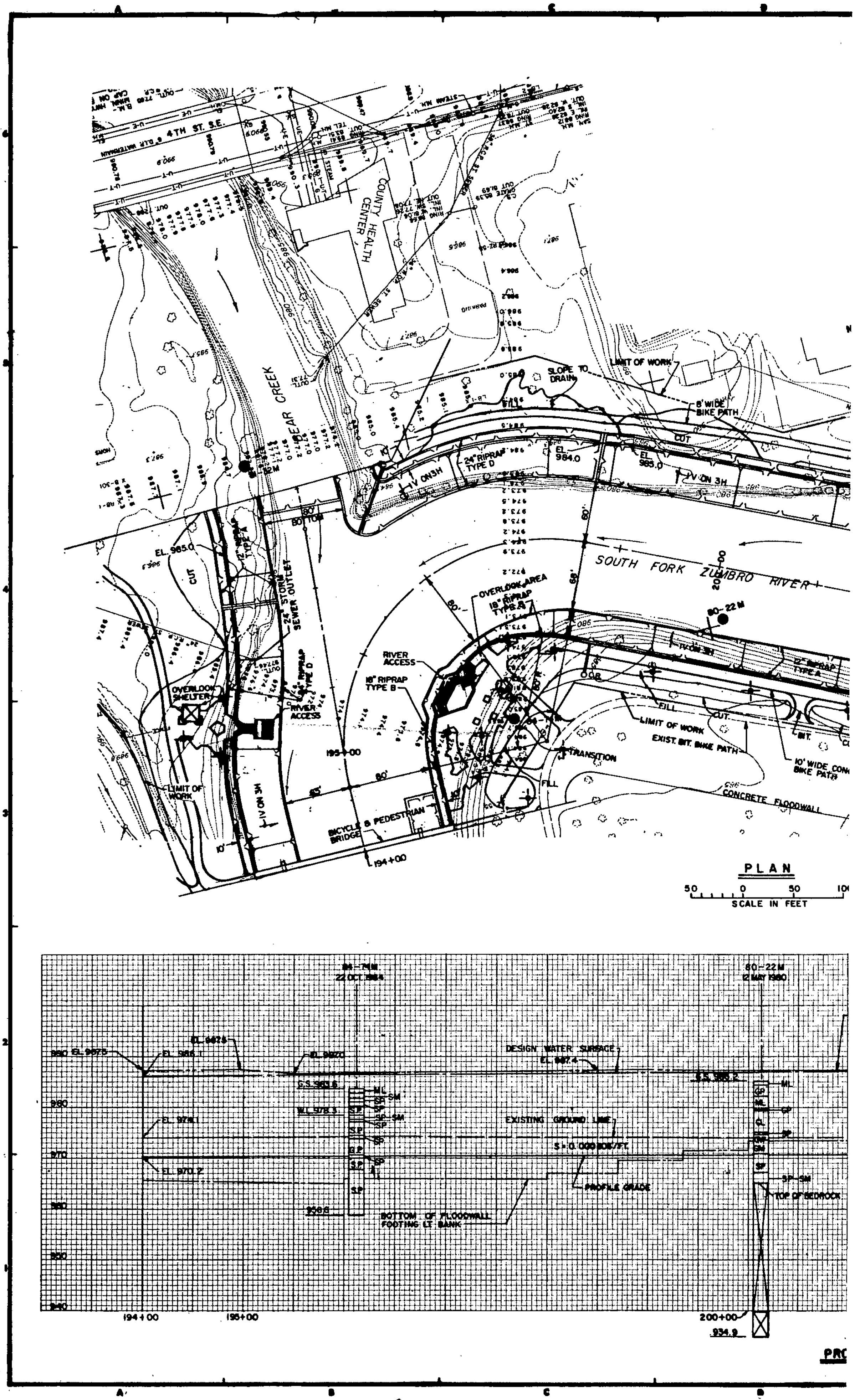
DESIGN MEMORANDUM NO. 2 — FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
PLAN AND PROFILE
183+50 TO 194+00

APPROVED BY:
DATE: APRIL 1966

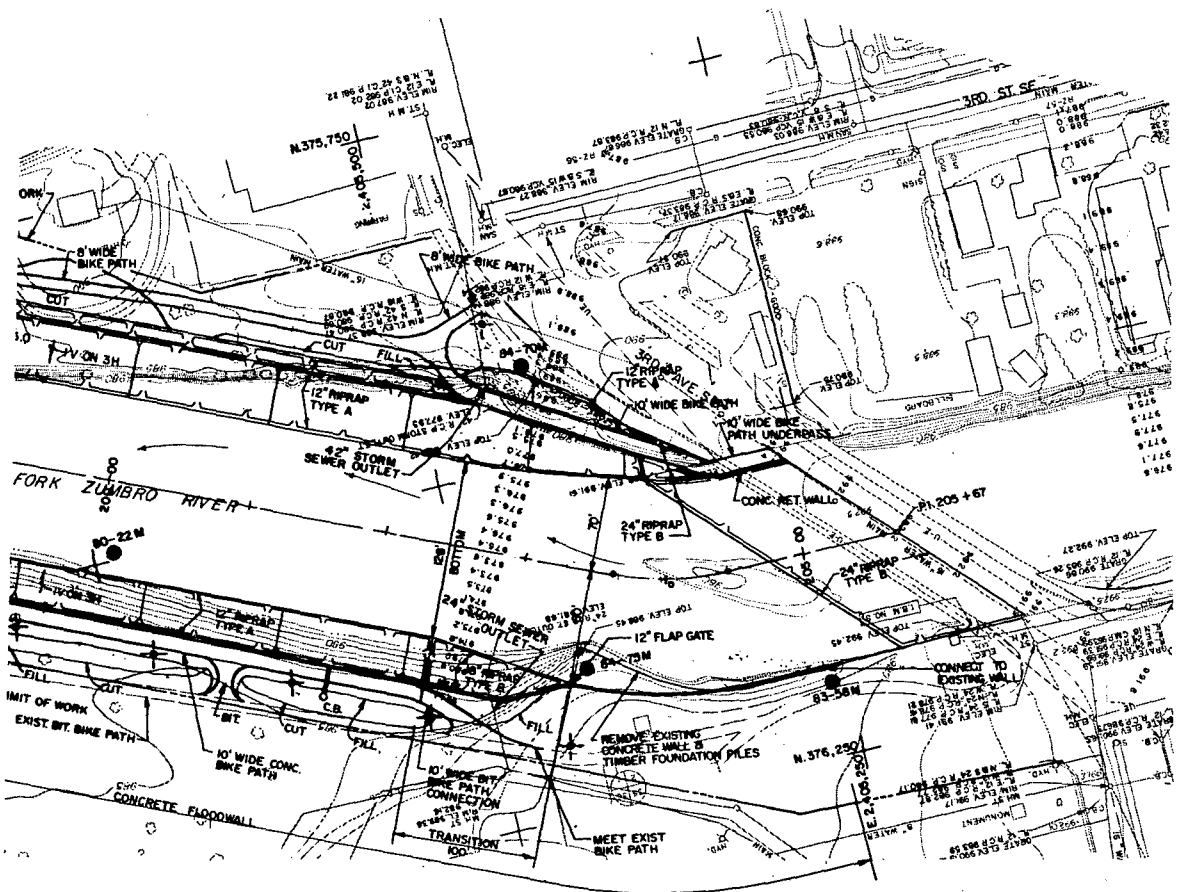
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-64/10
SHEET 21 OF 84

SAFETY PAYS

PLATE 21



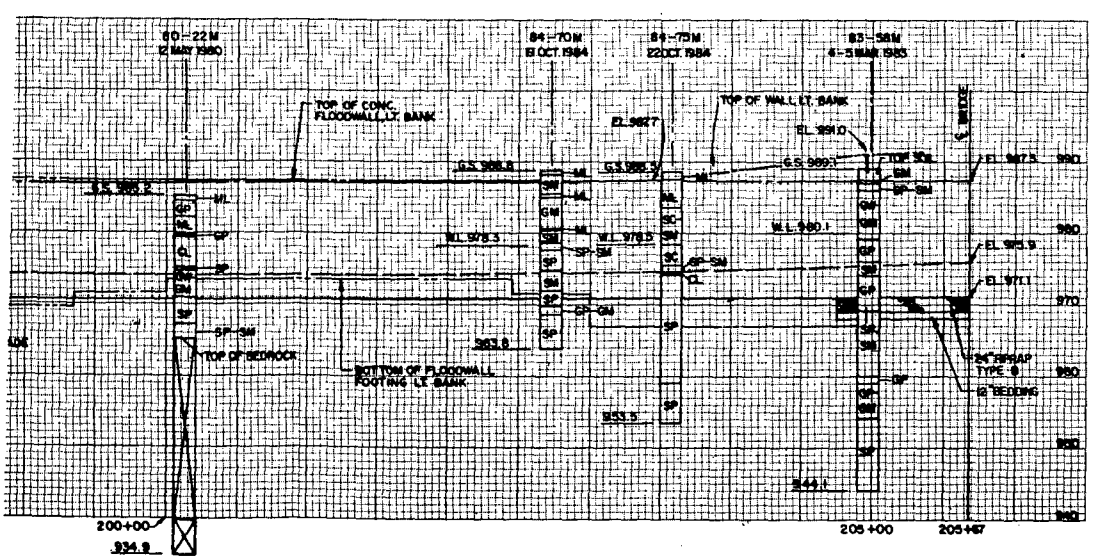
4TH ST. S.E.
COUNTY HEALTH CENTER
BEAR CREEK
SOUTH FORK ZUMBRO RIVER
LIMIT OF WORK
SLOPE TO DRAIN
8' WIDE BIKE PATH
CUT
FILL
EL. 984.0
EL. 985.0
1V ON 3H
24" RIPRAP TYPE D
18" RIPRAP TYPE A
18" RIPRAP TYPE B
12" RIPRAP TYPE A
OVERLOOK AREA
OVERLOOK SHELTER
RIVER ACCESS
24" STORM SEWER OUTLET
80' BOTTOM
80-22M
EXIST. BIT. BIKE PATH
10' WIDE CONC. BIKE PATH
TRANSITION
CONCRETE FLOODWALL
BICYCLE & PEDESTRIAN BRIDGE
194+00
195+00
PLAN
50 0 50 100
SCALE IN FEET
84-74M
22 OCT. 1984
80-22M
12 MAY 1980
DESIGN WATER SURFACE
EL. 987.4
EL. 987.5
EL. 986.1
EL. 987.0
EL. 974.1
EL. 970.2
G.S. 983.6
W.L. 978.3
G.S. 986.2
EXISTING GROUND LINE
S = 0.00080 FT./FT.
PROFILE GRADE
BOTTOM OF FLOODWALL FOOTING LT. BANK
TOP OF BEDROCK
200+00
934.9
990
980
970
960
950
940



PLAN

50 0 50 100
SCALE IN FEET

NOTE:
THE CITY OF ROCHESTER IS PLANNING (AS OF NOV. 24, 1986) TO REPLACE THE 3RD AVE BRIDGE, THEREFORE THE FINAL PLAN FOR THE BRIDGE AREA WILL BE REVISED.



PROFILE

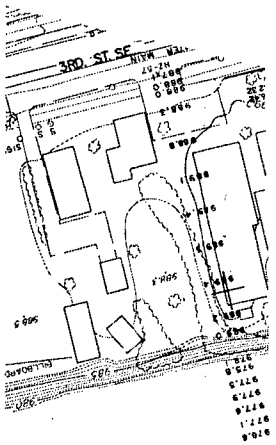
SAFETY PAYS

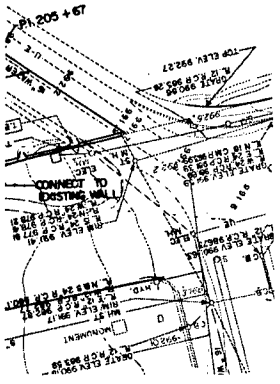
SYMBOL	DESCRIPTION

WHKS - Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

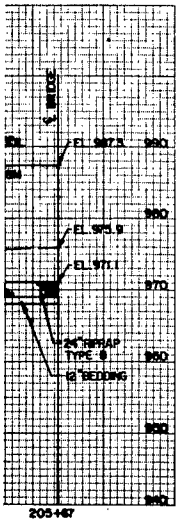
DESIGNED BY: G.E.F. D.O.
DRAWN BY: G.E.M.A.R.R.
CHECKED BY: D.J.R./D.O.
SUBMITTED BY:

DESIGN MEMORANDU
FLOOD CON
RO
PI





ESTER IS PLANNING (AS OF NOV. 24, 1986)
3RD AVE BRIDGE, THEREFORE THE FINAL
DGE AREA WILL BE REVISED.



LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

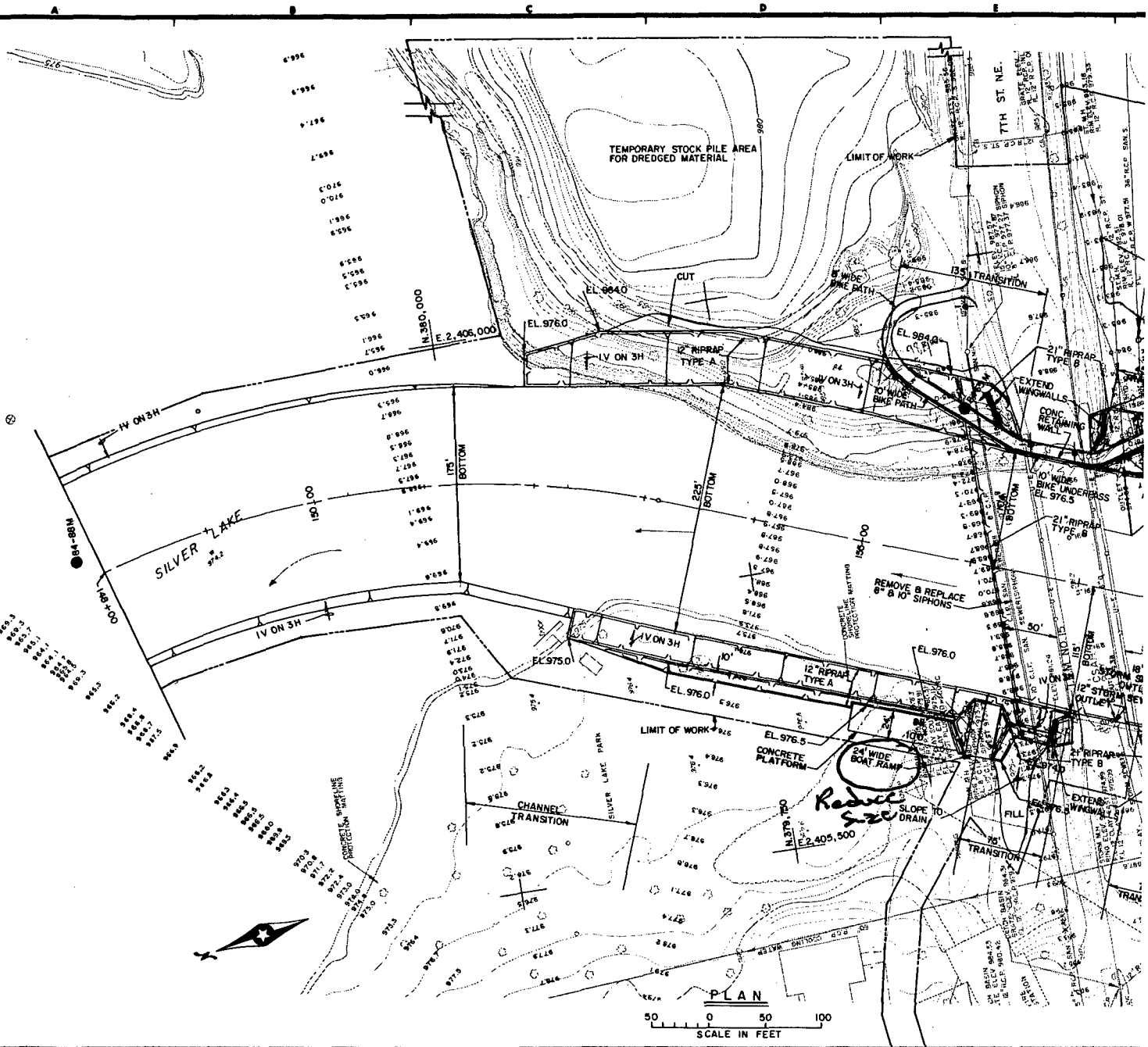
DESIGNED BY: G.E.F.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.R./D.D.
SUBMITTED BY:

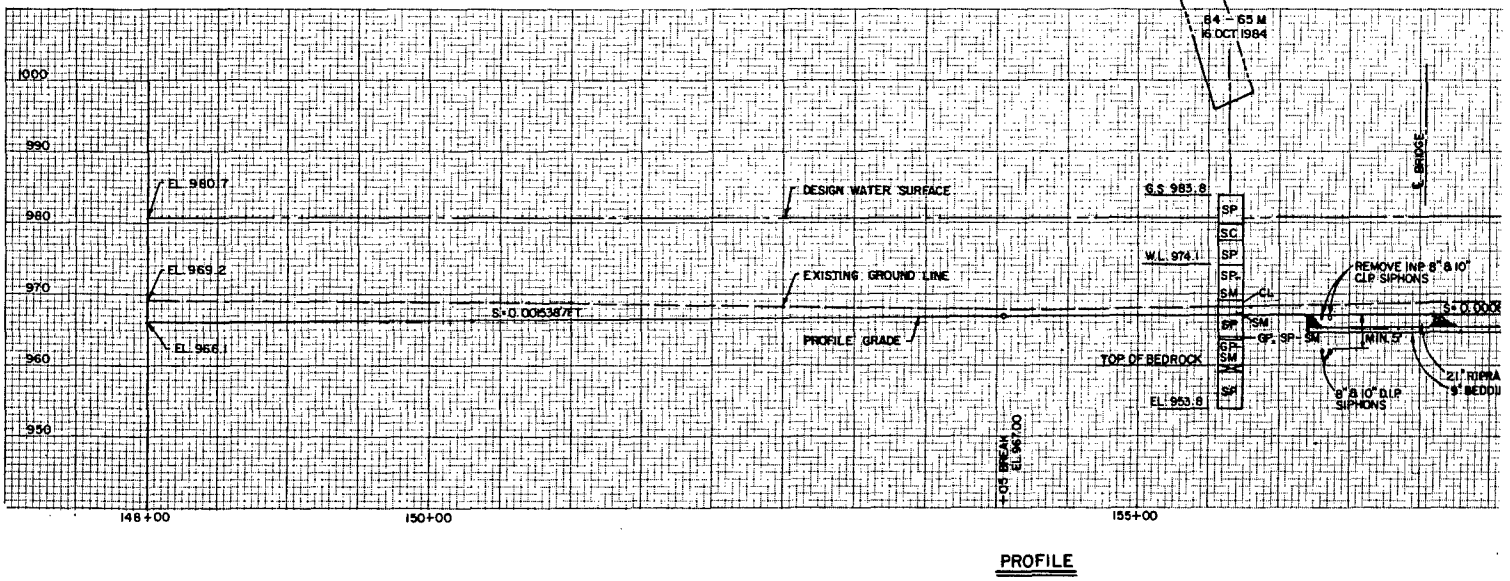
DESIGN MEMORANDUM NO. 2 — FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
PLAN AND PROFILE
194+00 TO 205+67

APPROVED BY:
DATE: APRIL 1988
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-64/11
SHEET 22 OF

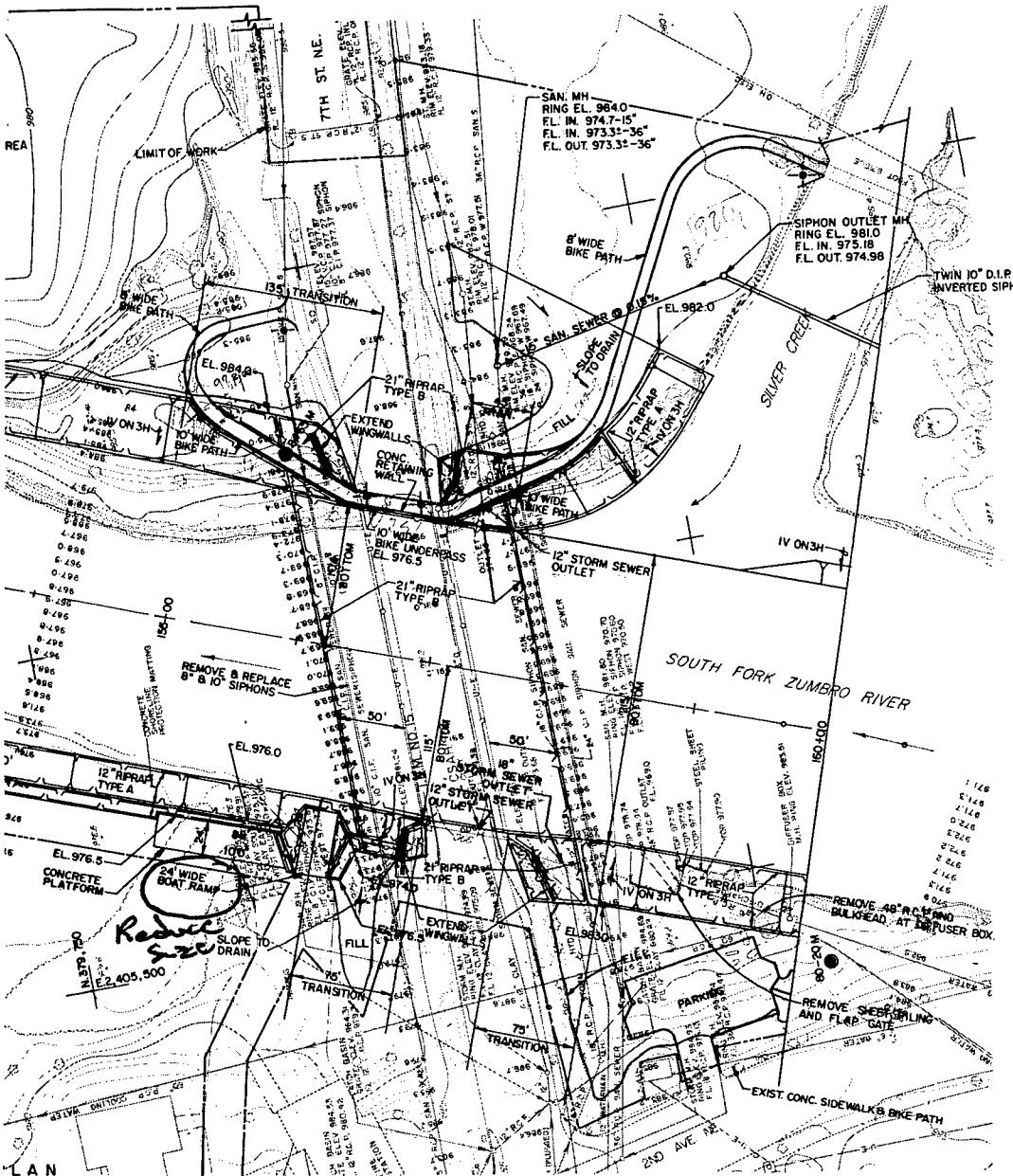
PLATE 2

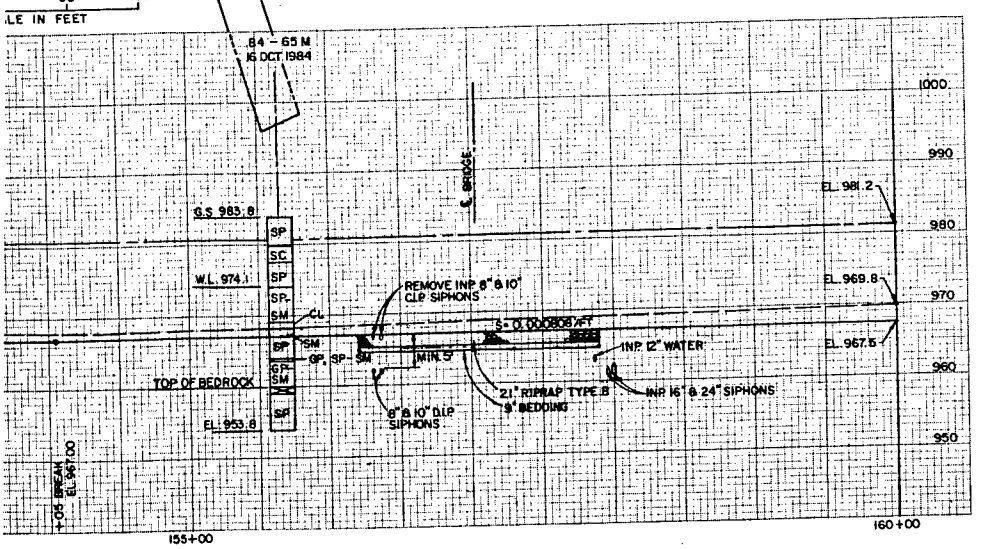
3


TEMPORARY STOCK PILE AREA FOR DREDGED MATERIAL
LIMIT OF WORK
CUT
EL. 984.0
EL. 976.0
N. 380,000
E. 2,406,000
1V ON 3H
12" RIPRAP TYPE A
8' WIDE BIKE PATH
135' TRANSITION
EL. 984.0 (E)
21" RIPRAP TYPE B
EXTEND WINGWALLS
CONC. RETAINING WALL
10' WIDE BIKE UNDERPASS EL. 976.5
175' BOTTOM
225' BOTTOM
150' BOTTOM
190'
150'
SILVER LAKE
84-88M
148+00
REMOVE & REPLACE 6"-8"-10" SIPHONS
EL. 975.0
EL. 976.0
10'
50'
100'
LIMIT OF WORK
EL. 976.5
CONCRETE PLATFORM
24' WIDE BOAT RAMP
CHANNEL TRANSITION
SILVER LAKE PARK
CONCRETE SHORELINE PROTECTION MATTING
Reduce Size
SLOPE TO DRAIN
FILL
75' TRANSITION
N. 379,100
E. 2,405,500
7TH ST. N.E.
PLAN
50 0 50 100
SCALE IN FEET


84 - 85 M
16 OCT 1984
1000
990
980
970
960
950
EL. 980.7
EL. 969.2
EL. 956.1
S=0.005367/FT.
DESIGN WATER SURFACE
EXISTING GROUND LINE
PROFILE GRADE
TOP OF BEDROCK
G.S 983.8
W.L. 974.1
EL. 953.8
SP
SC
SM
CL
GP
REMOVE IN 8"&10" CLP SIPHONS
MIN. 5'
8"&10" D.I.P SIPHONS
21" RIPRA
BRIDGE
148+00
150+00
155+00

PROFILE





PROFILE

-⊕- LIGHTING LOCATIO

SYMBOL	DESCRIPTION

WHKS - Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

DEPARTMEN
ST. PAUL DISTRICT
ST. PAU

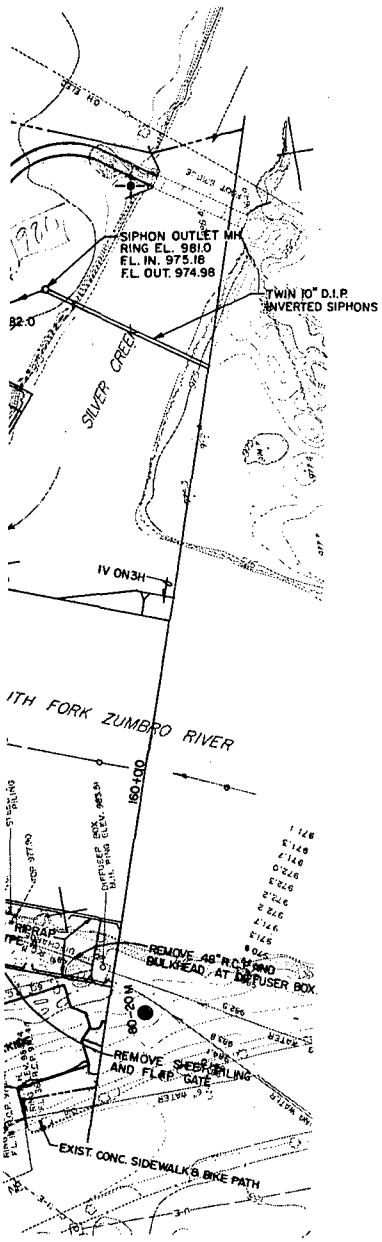
DESIGNED BY: G.E.F. D.O.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.P/ D.O.
SUBMITTED BY: CHIEF, ENGR. DIV.
APPROVED BY: CHIEF, BRANCH

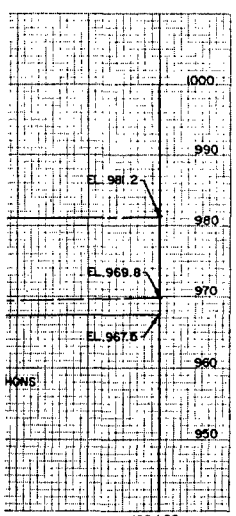
DESIGN MEMORANDUM NO.2
FLOOD CONTROL SOUTH FORK
ROCHESTER, MINNI
STAGE IE
PLAN AND PRO
148+00 TO 160

APF

SCALE AS SHOWI
DRA
M3
SHEET 18 OF

2





LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS - Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

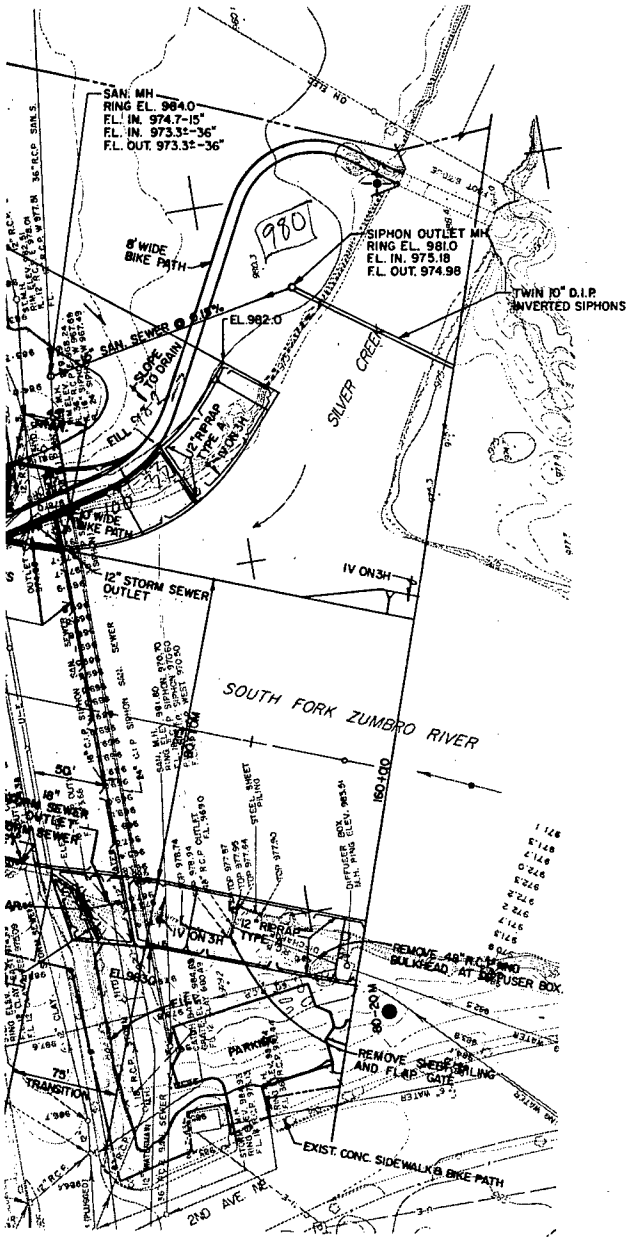
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: G.E.F. D.O.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.P./ D.O.
SUBMITTED BY: CHIEF, ENG. DIV. / CHIEF, DESIGN BRANCH
APPROVED BY: CHIEF, ENG. DIV. / CHIEF, ENGR. BRANCH

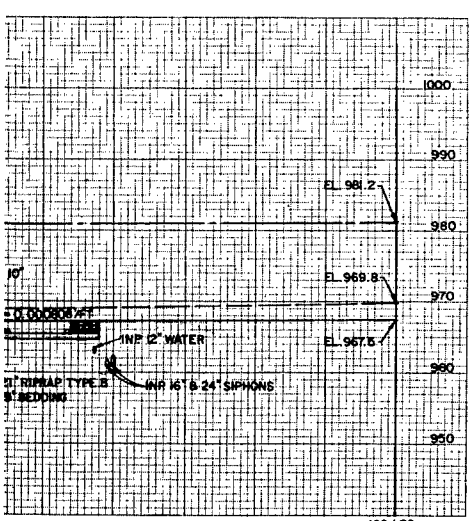
DESIGN MEMORANDUM NO. 2 — FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
PLAN AND PROFILE
148+00 TO 160+00

DATE: APRIL 1968
SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER: M30-R-64/7
SHEET 18 OF 61

PLATE 18



3/16" = 50'



LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS - Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

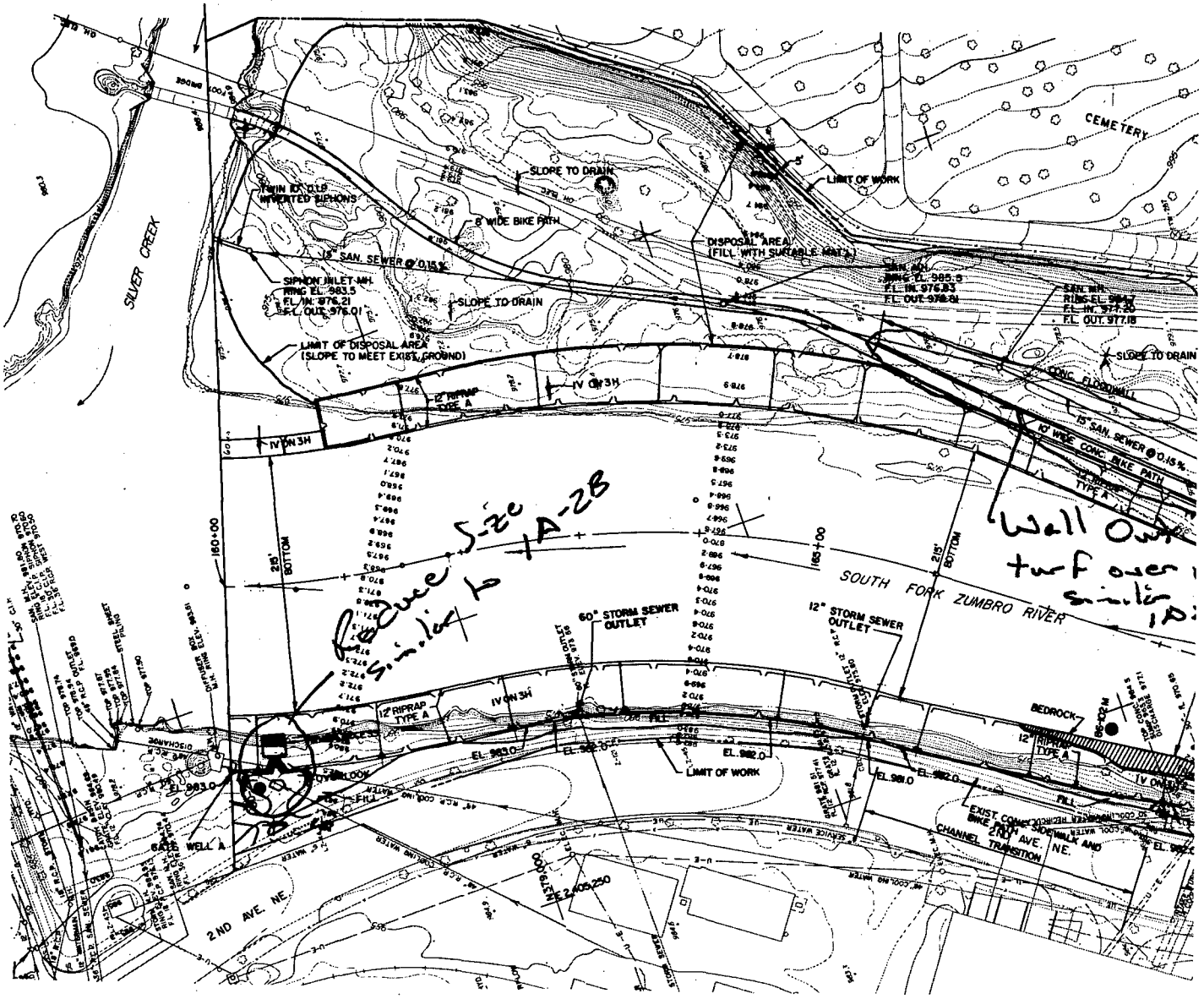
DESIGNED BY: G.E.F. D.Q.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.E/D.Q.
SUBMITTED BY: [signature] CHIEF, ENGR. DIV.
APPROVED BY: [signature] CHIEF, ENGR. DIVISION

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
PLAN AND PROFILE
148+00 TO 160+00

DATE: APRIL 1966
SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER: M30-R-64/7
SHEET 18 OF 48

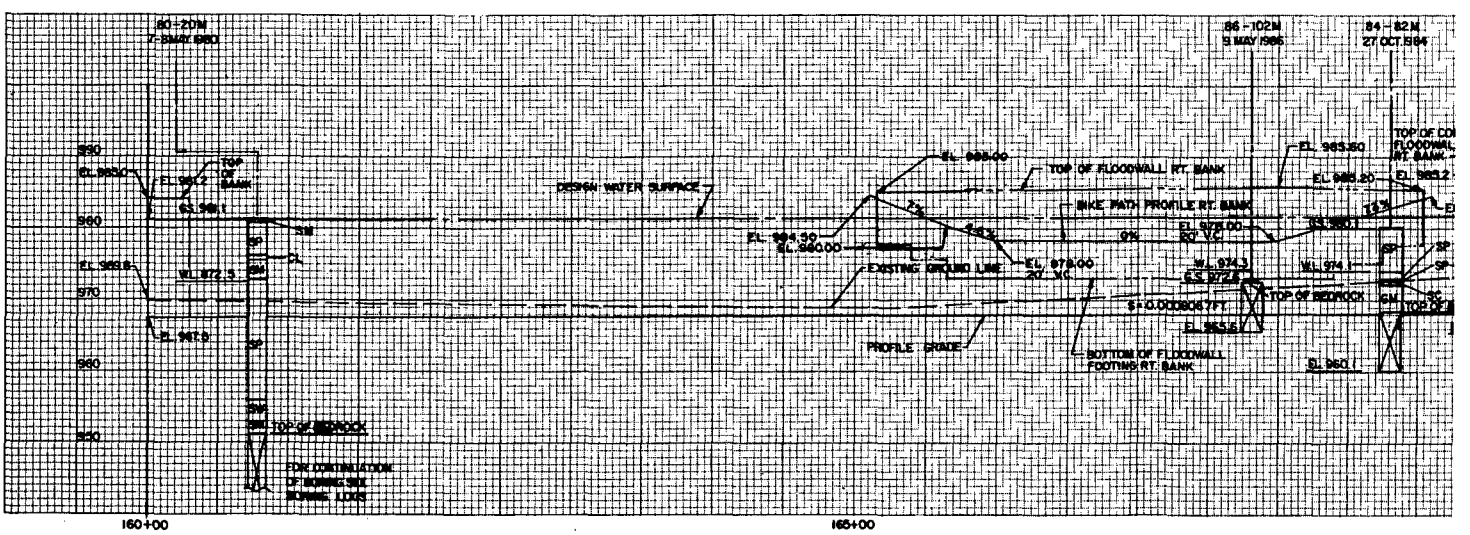
PLATE 18

3

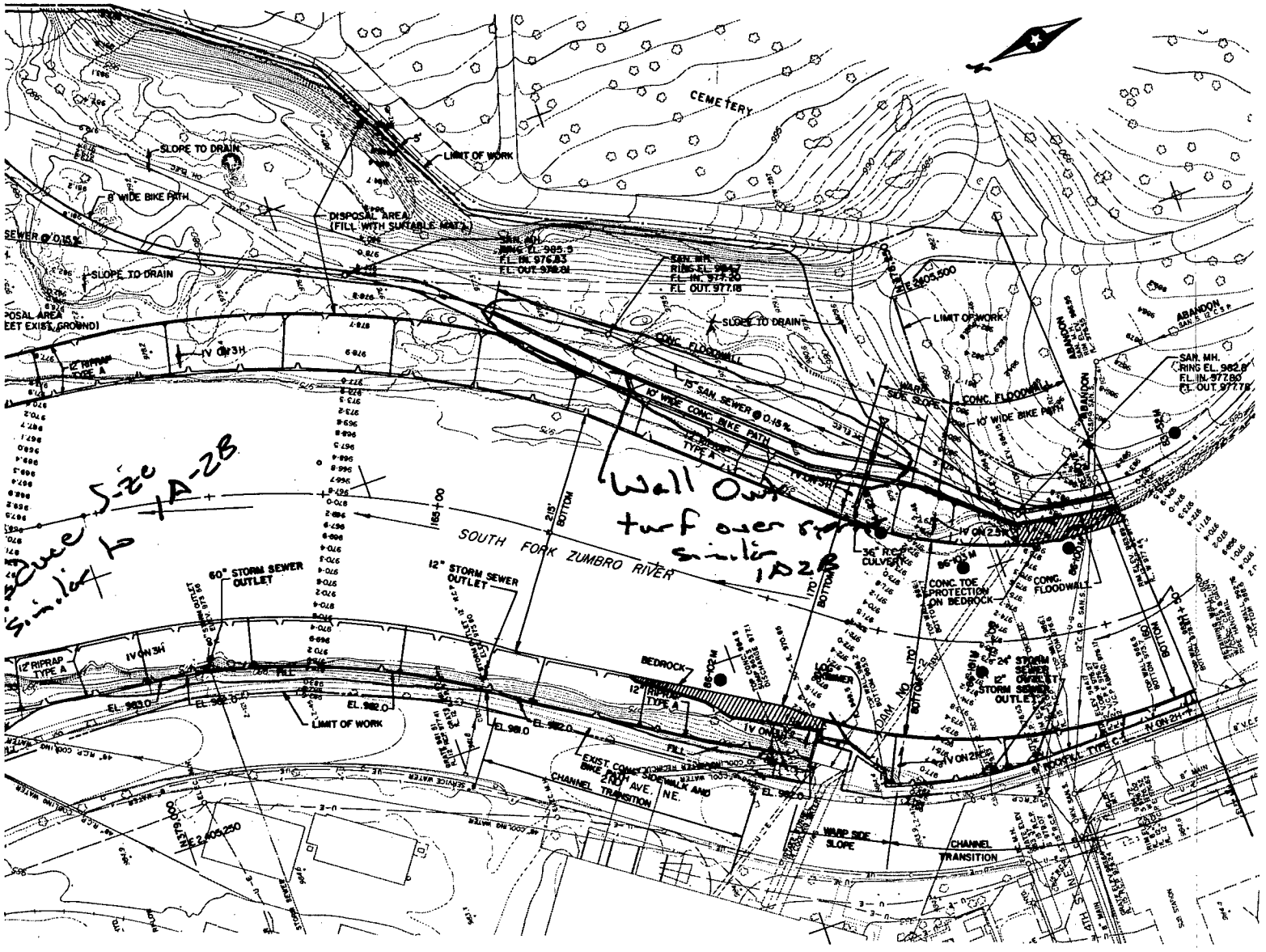


PLAN

50 0 50 100
SCALE IN FEET

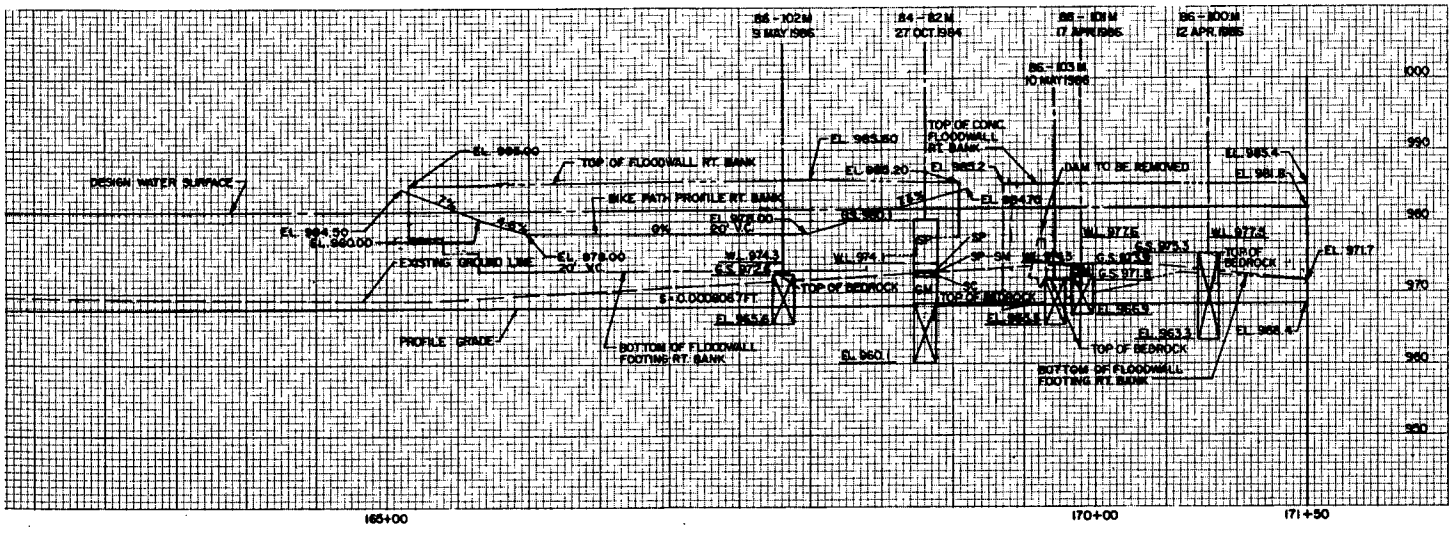


PROFILE

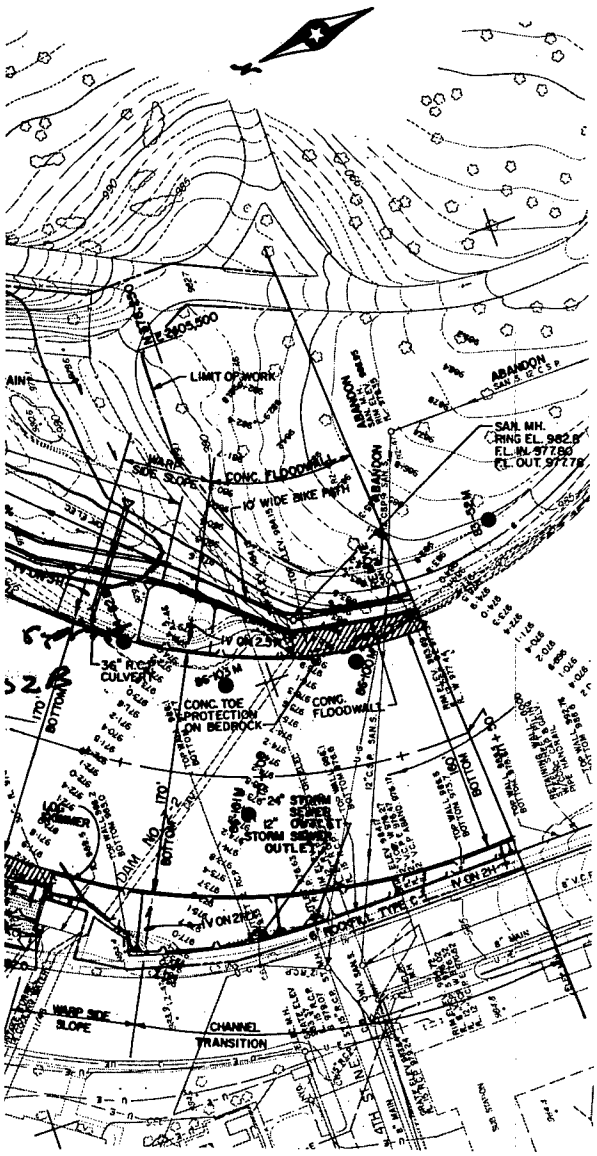


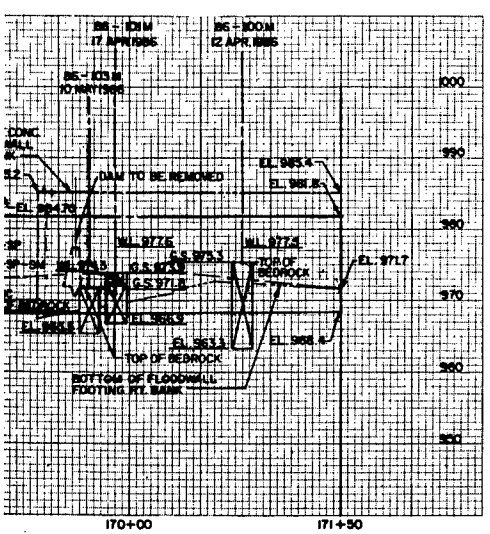
PLAN

50 0 50 100
SCALE IN FEET



PROFILE





LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: G.E.E./D.O.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.P./D.O.
SUBMITTED BY:

DESIGN MEMORANDUM NO.2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
PLAN AND PROFILE
160+00 TO 171+50

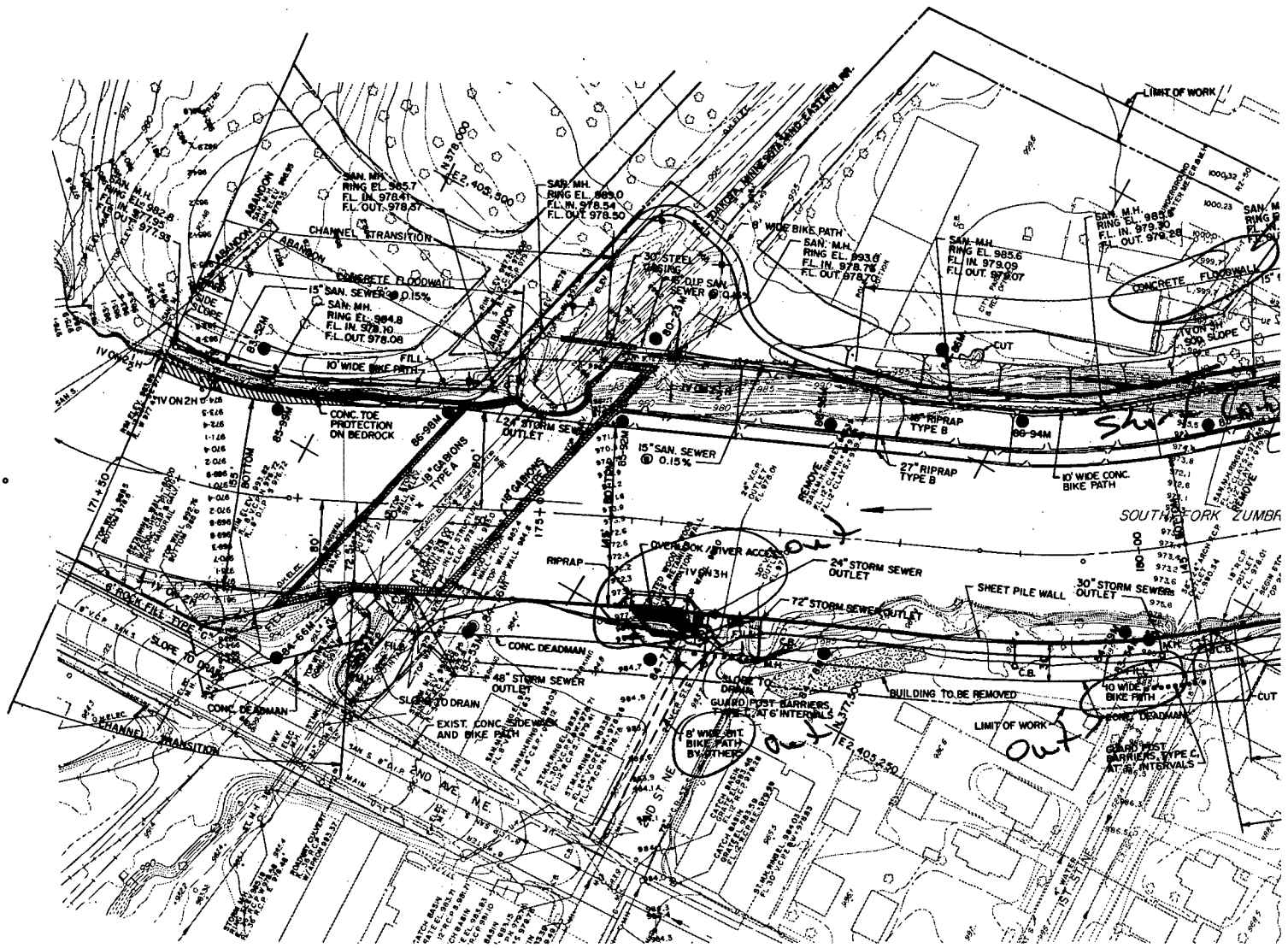
APPROVED BY: Robert L. Post
DATE: APRIL 1966

SCALE: AS SHOWN
ENG. NO.

DRAWING NUMBER
M30-R-64/8
SHEET 19 OF 51.

SAFETY DAYS

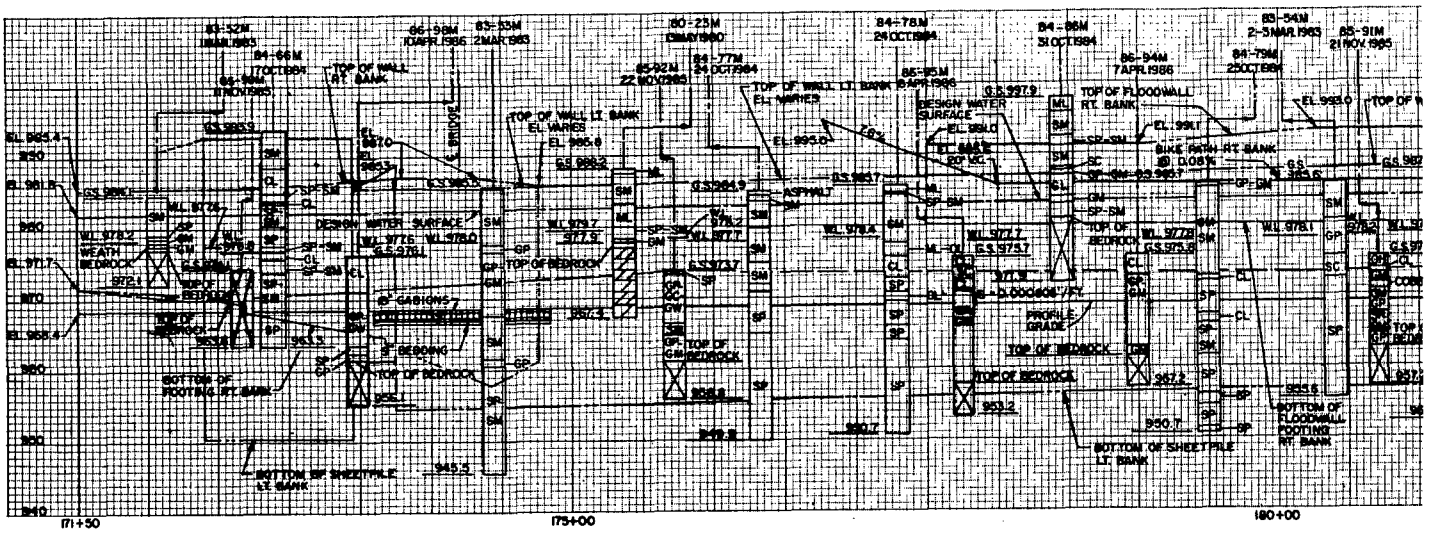
PLATE 19



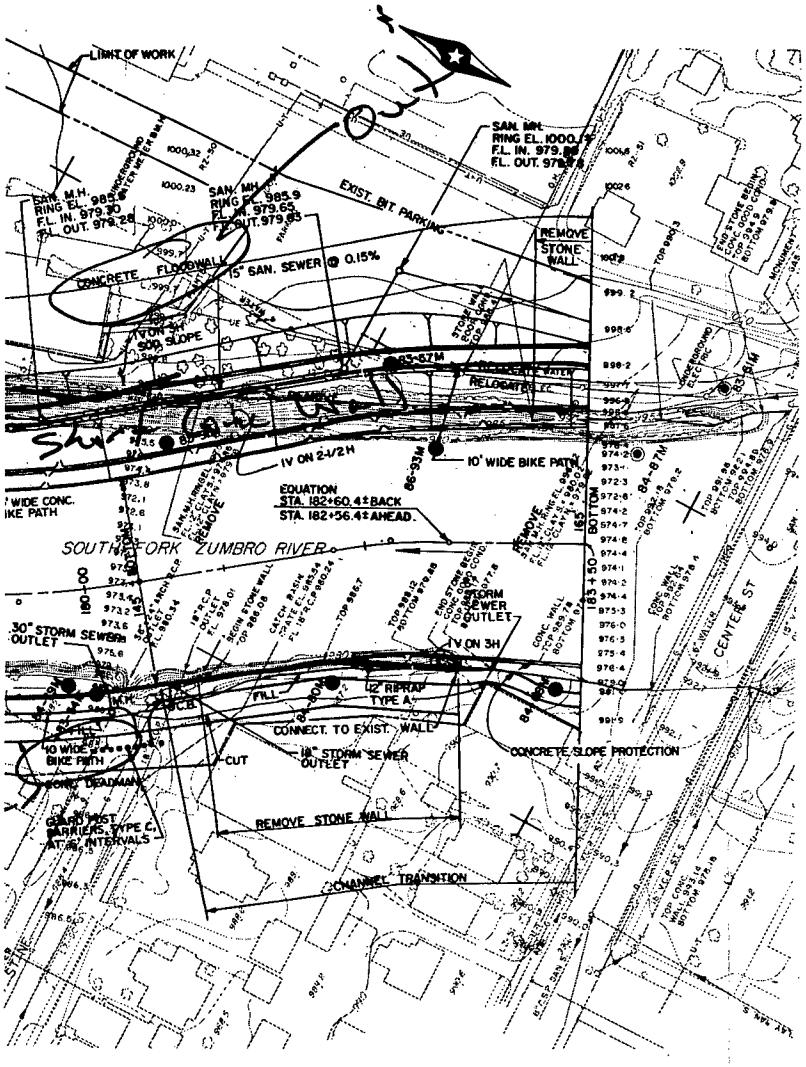
PLAN

50 0 50 100

SCALE IN FEET



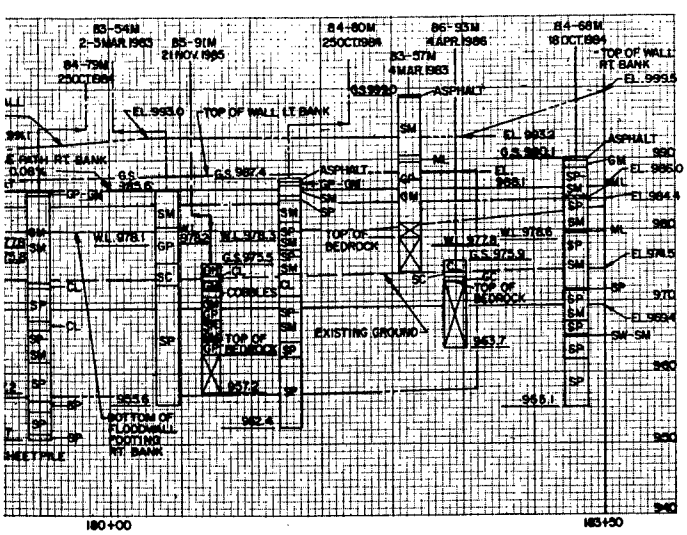
PROFILE



PLAN

0 50 100

SCALE IN FEET



LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS - Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

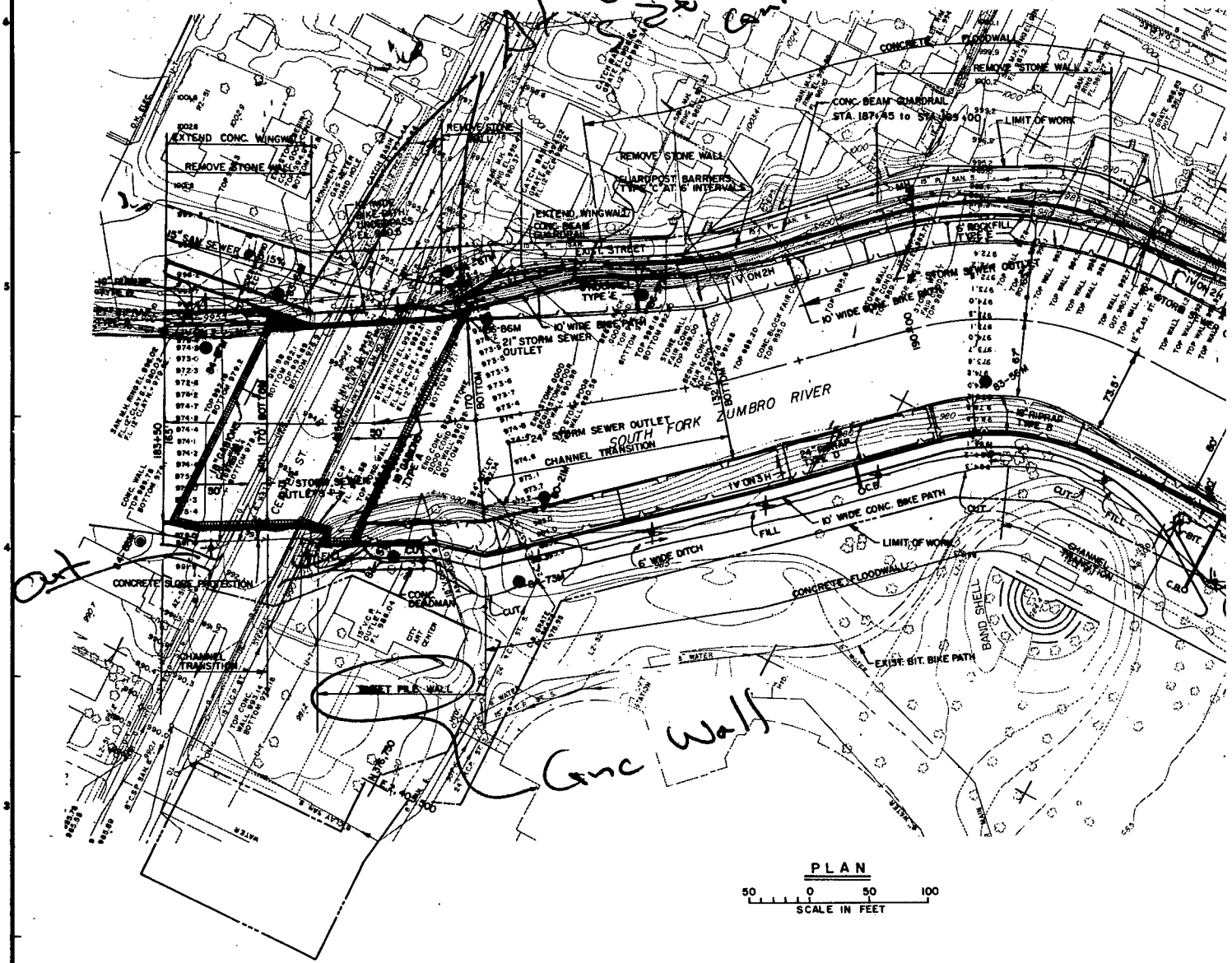
DESIGNED BY: G.E.F./D.O.
DRAWN BY: G.E.M./K.R.R.
CHECKED BY: D.J.P./D.O.
SUBMITTED BY:
APPROVED BY:

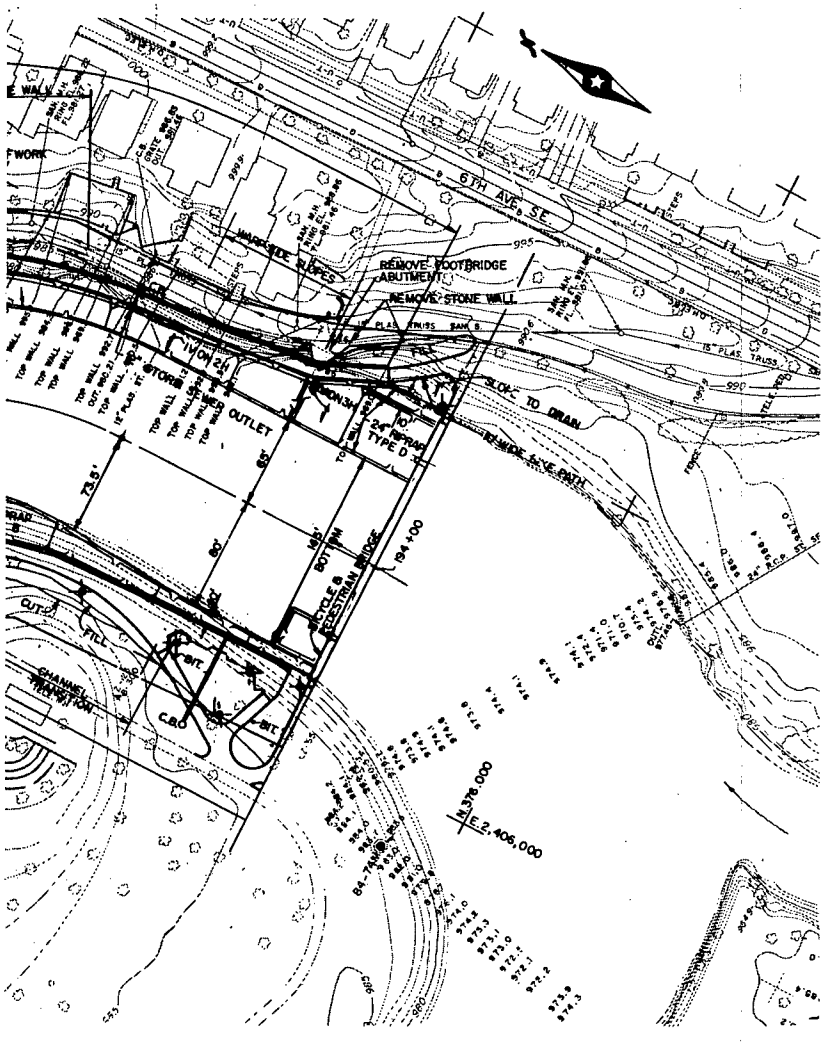
DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
PLAN AND PROFILE
171+50 TO 183+50

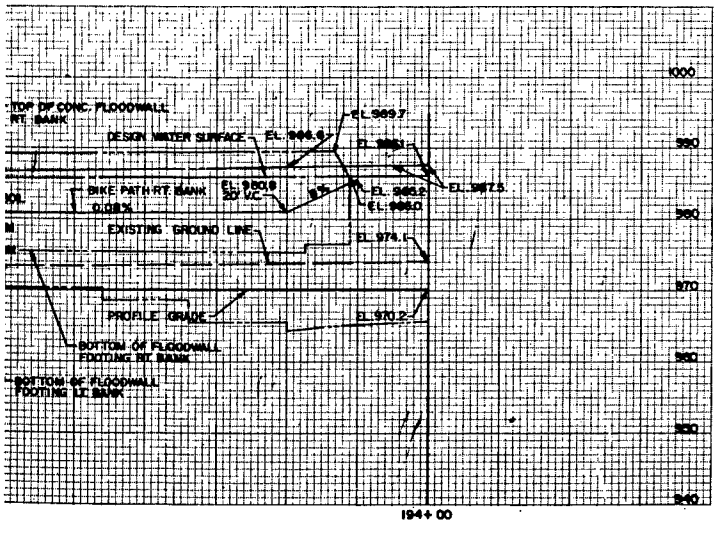
DATE: APRIL 1968
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-64/9
SHEET 20 OF 24

SAFETY DAY

PLATE 20


Grade
Sidewalk
connections
Out
Conc Wall
EXTEND CONC. WINGWALL
REMOVE STONE WALL
CONC. BEAM GUARDRAIL
STA. 187+45 to STA. 189+00
LIMIT OF WORK
REMOVE STONE WALL
GUARDPOST BARRIERS (TYPE 'C') AT 6' INTERVALS
EXTEND WINGWALL
CONC. BEAM GUARDRAIL
S. FORK STREET
15" SAN. SEWER @ 15%
TYPE 'E'
10' WIDE BIKE PATH
21" STORM SEWER OUTLET
SOUTH FORK ZUMBRO RIVER
STORM SEWER OUTLET
CHANNEL TRANSITION
1V ON 2H
1V ON 3H
10' WIDE CONC. BIKE PATH
6' WIDE DITCH
CONCRETE FLOODWALL
CONCRETE SLOPE PROTECTION
CONC. DEADMAN
SHEET PILE WALL
EXIST. BIT. BIKE PATH
BAND SHELL
PLAN
SCALE IN FEET
TOP OF WALL RT. BANK
TOP OF WALL LT. BANK
WINGWALL EXTN. RT. BANK
TOP OF CONC. FLOODWALL LT. BANK
TOP OF CONC. FLOODWALL RT. BANK
DESIGN WATER SURFACE
BOTTOM OF FOOTING RT. BANK
TOP OF BEDROCK
WEATHERED BEDROCK
BOTTOM OF FLOODWALL FOOTING RT. BANK
BOTTOM OF SHEET PILE LT. BANK
BOTTOM OF FLOODWALL FOOTING LT. BANK
BIKE PATH PROFILE
EXISTING GROUND
PROFILE GRADE
183+50
185+00
190+00
PROFILE





LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Minn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: G.E.F. D.O.
DRAWN BY: G.E.N./K.R.R.
CHECKED BY: D.J.P./D.O.
SUBMITTED BY:

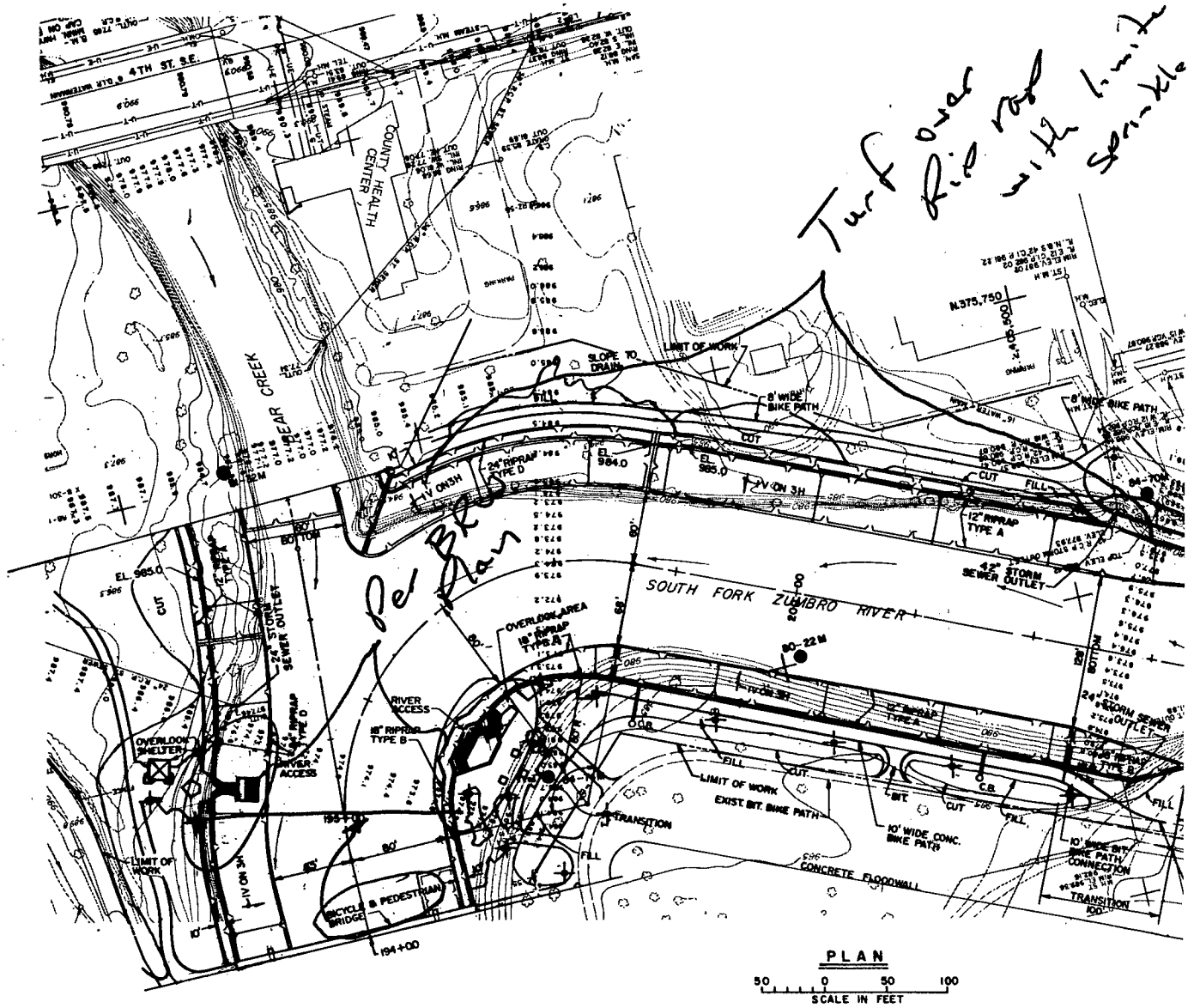
DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
PLAN AND PROFILE
183+50 TO 194+00

APPROVED BY:
DATE: APRIL 1968

SCALE: AS SHOWN
DRAWING NUMBER: M30-R-64/10
SHEET 21 OF 84

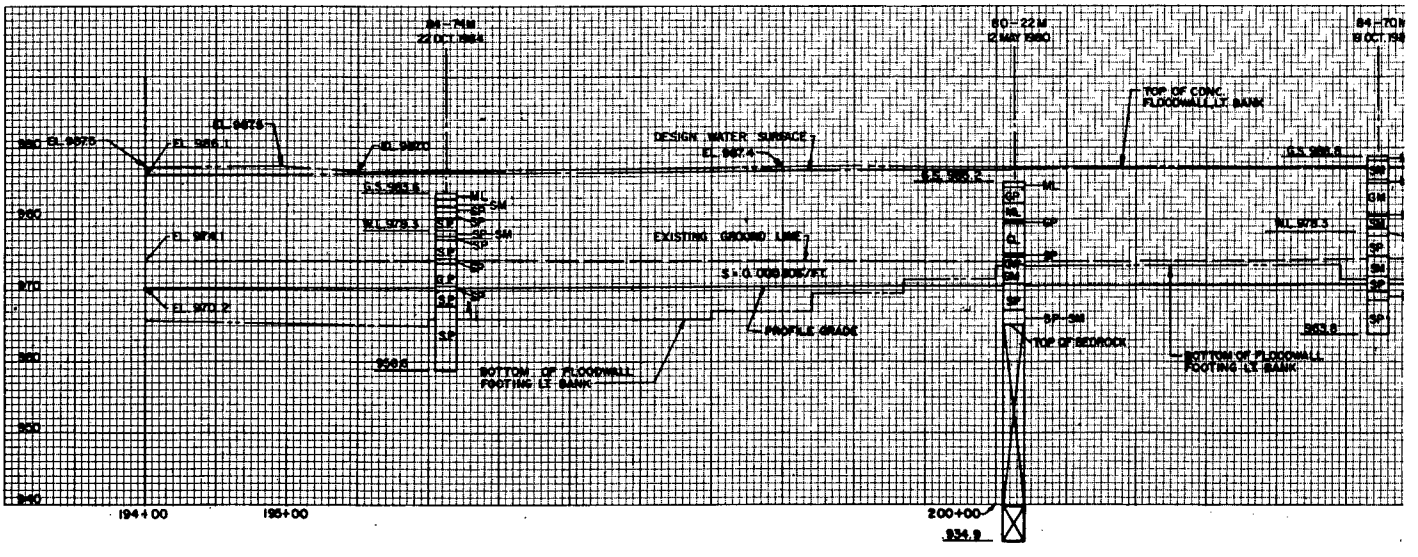
SAFETY PAYS

PLATE 21

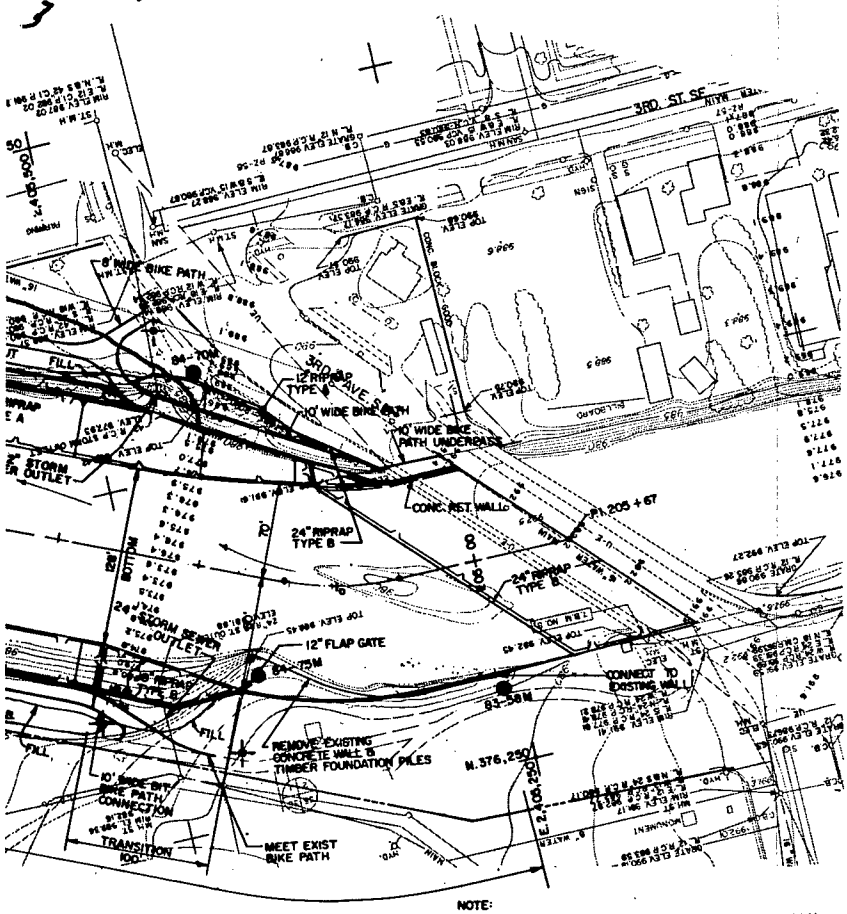


PLAN

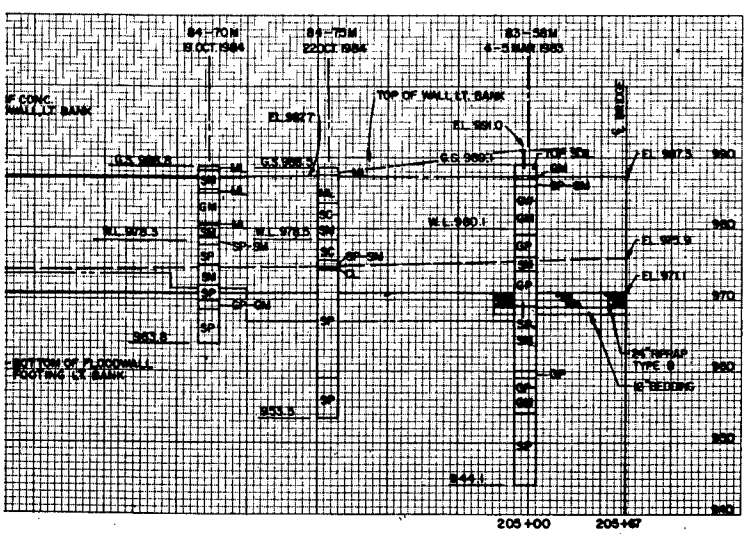
50 0 50 100
SCALE IN FEET



PROFILE



NOTE:
THE CITY OF ROCHESTER IS PLANNING (AS OF NOV. 24, 1986) TO REPLACE THE 3RD AVE BRIDGE, THEREFORE THE FINAL PLAN FOR THE BRIDGE AREA WILL BE REVISED.



LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS — Professional Engineers & Planners
Mason City, Ia. — Rochester, Mn. — Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

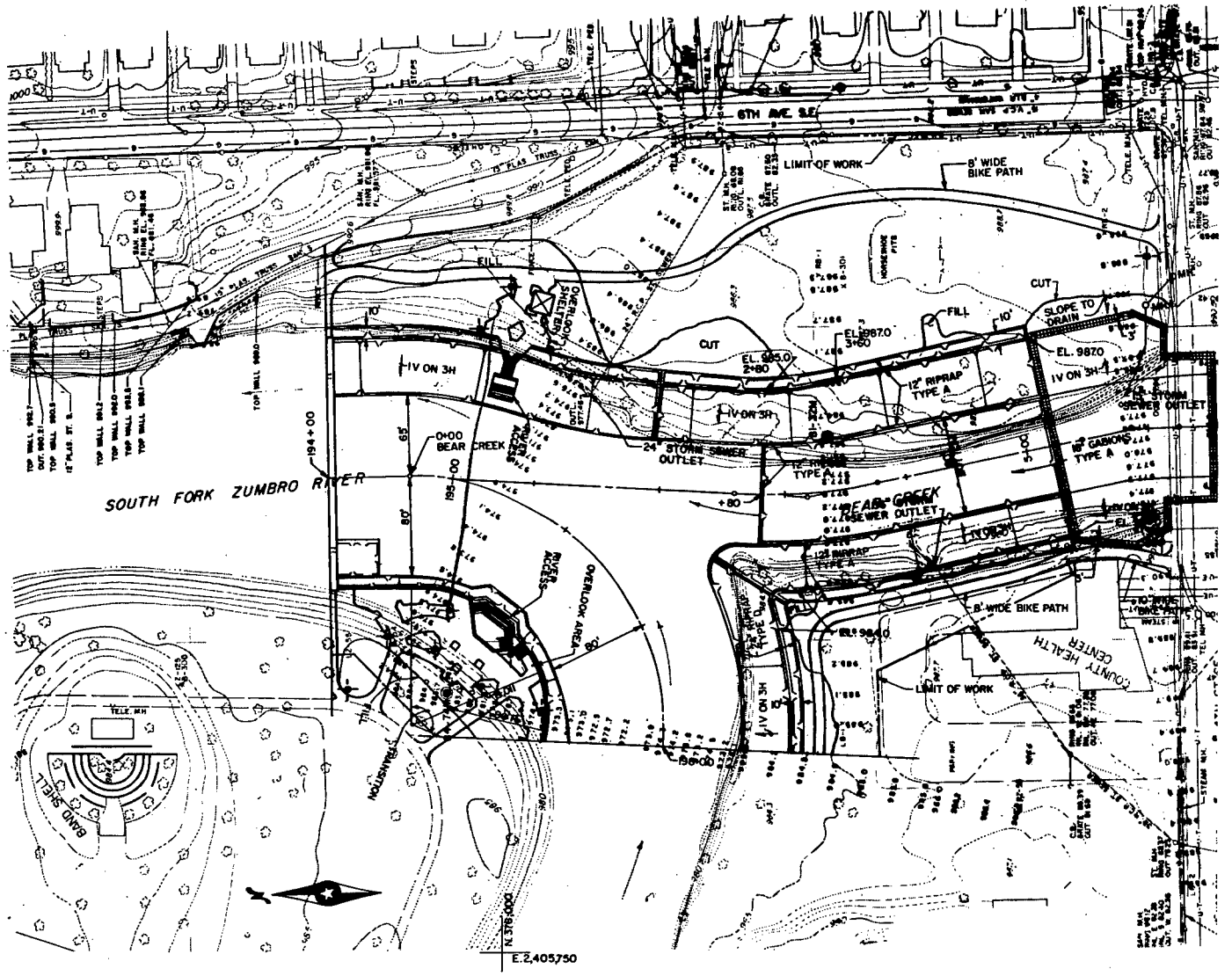
DESIGNED BY: G.E.F. D.O.
DRAWN BY: G.E.M./K.R.R.
CHECKED BY: D.J.R./D.D.
SUBMITTED BY:

DESIGN MEMORANDUM NO. 2 — FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
PLAN AND PROFILE
194+00 TO 205+67

APPROVED BY:
DATE: APRIL 1988
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-66/11

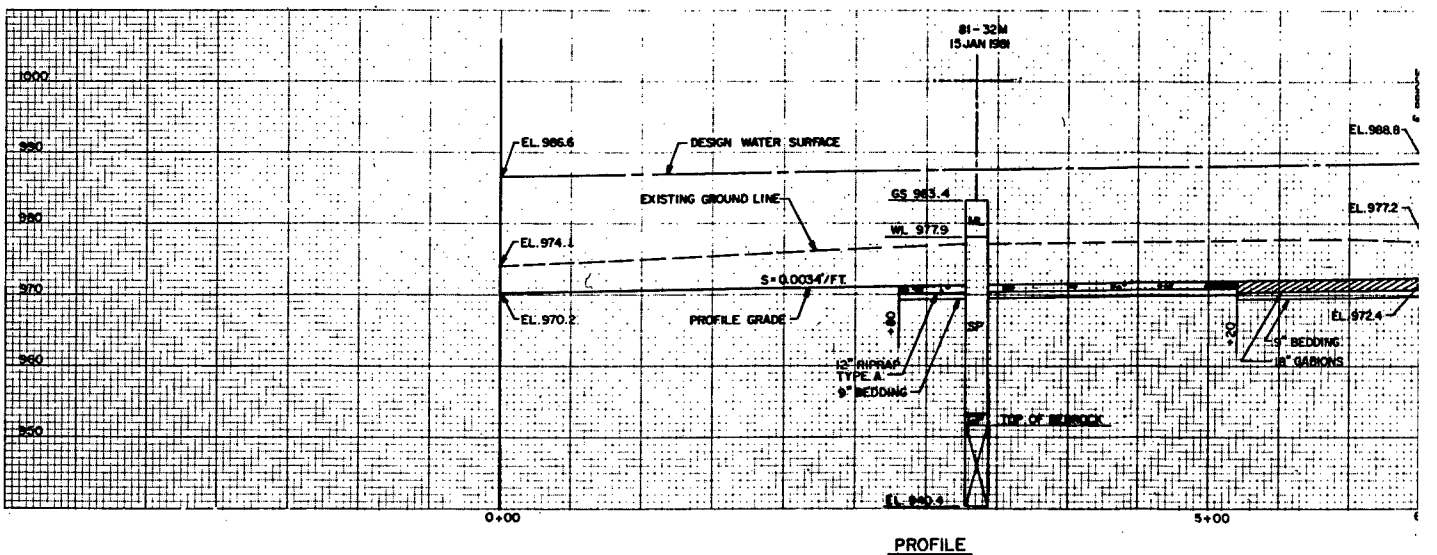
SAFETY PAYS

PLATE

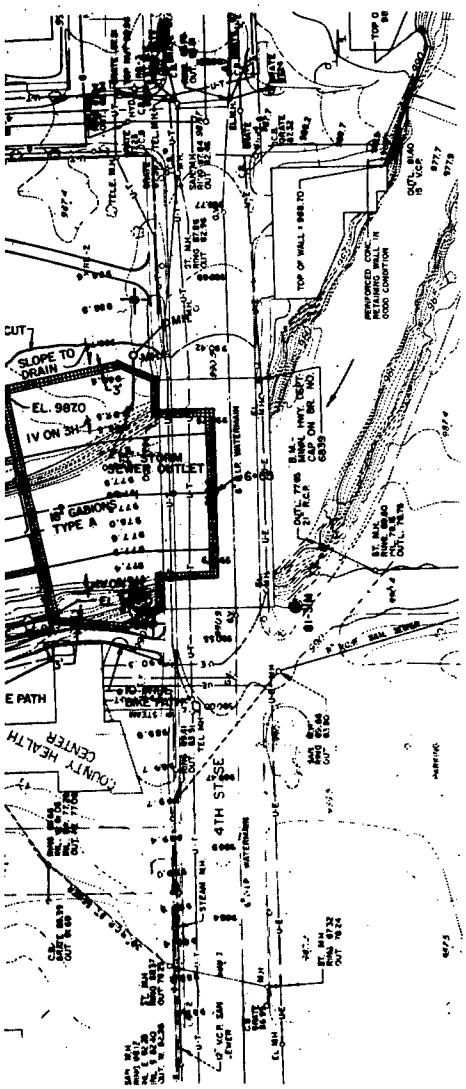


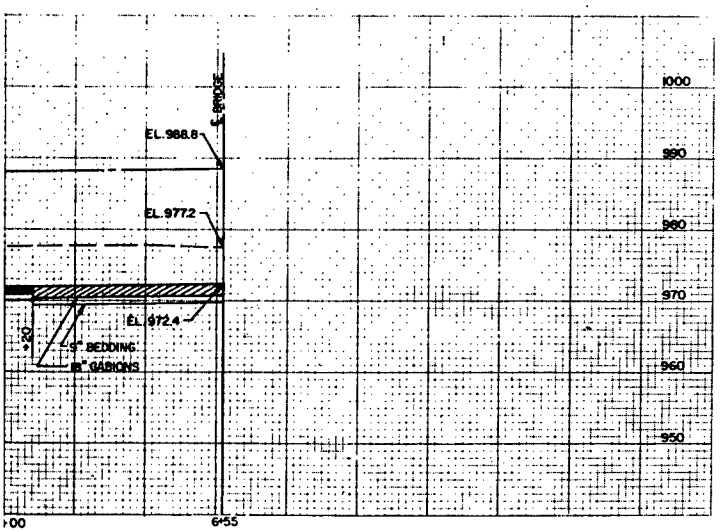
PLAN

50 0 50 100
SCALE IN FEET



PROFILE





LIGHTING LOCATIONS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

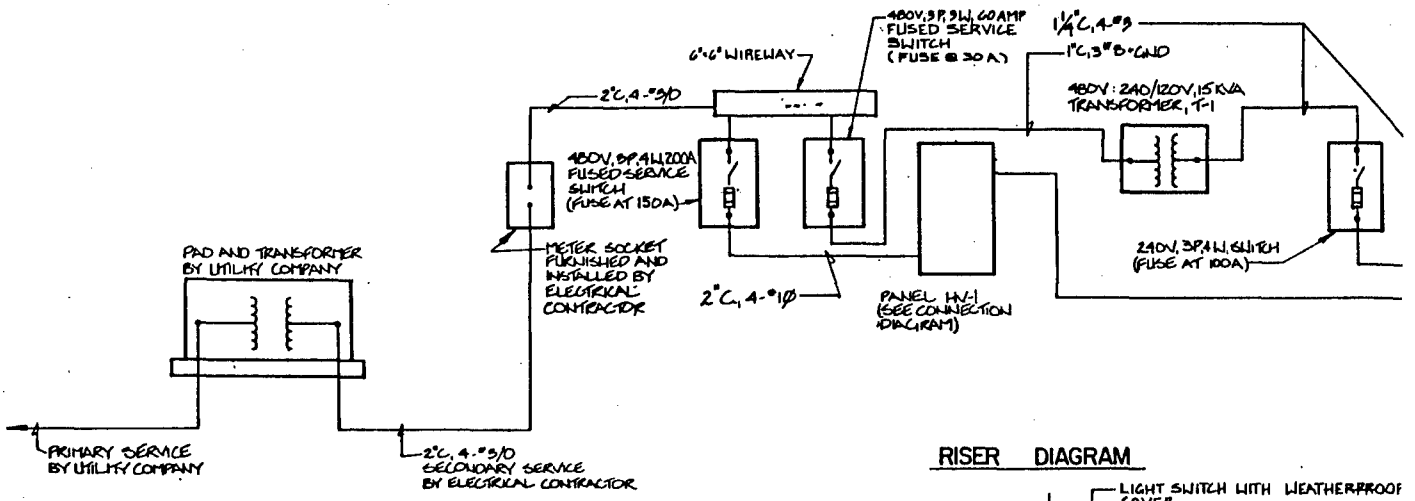
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

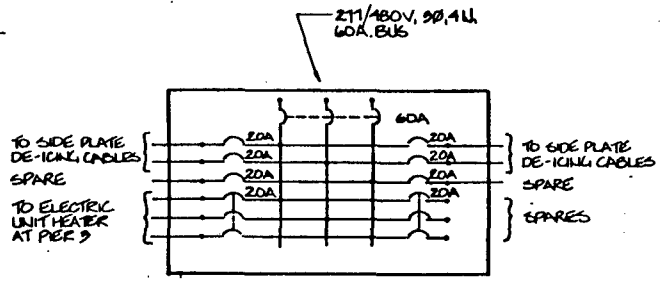
DESIGNED BY: D.O.
DRAWN BY: K.R.R
CHECKED BY: D.O.
SUBMITTED BY:

DESIGN MEMORANDUM NO.2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
PLAN AND PROFILE
0+00 TO 6+55 (BEAR CREEK)

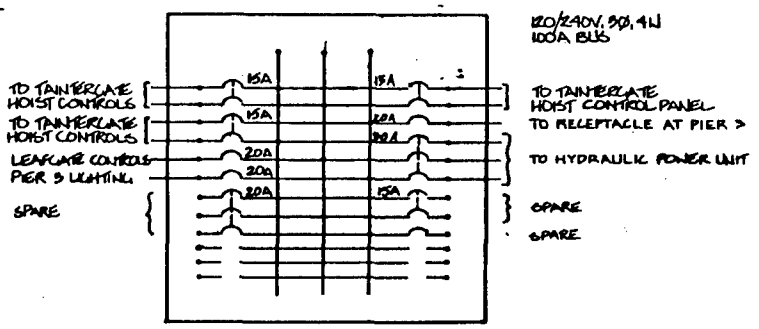
APPROVED BY:
DATE: APRIL 1988
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-64/12
SHEET 23 OF 51

SAFETY DAYS

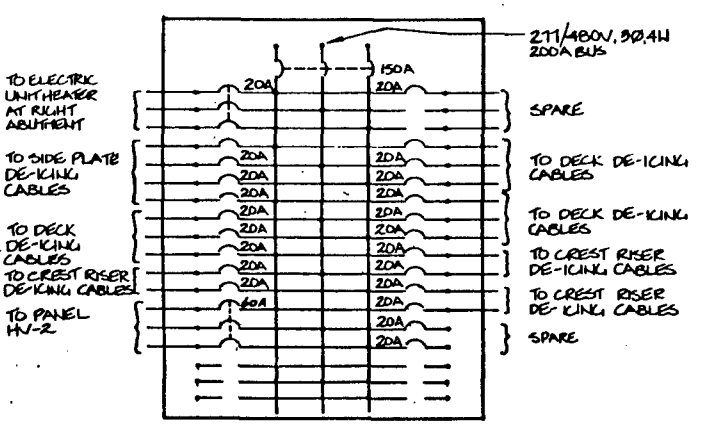




PANEL HV-2
CONNECTION DIAGRAM

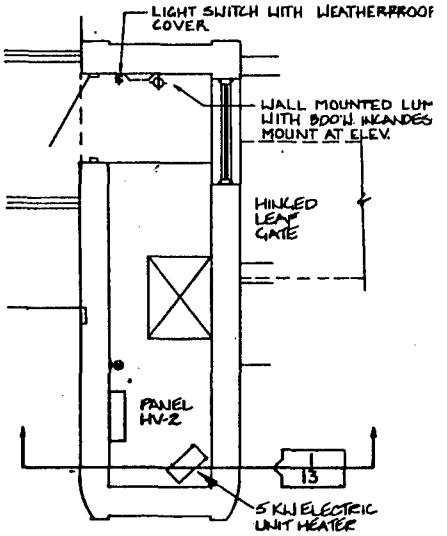


PANEL LV-1
CONNECTION DIAGRAM

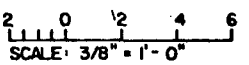


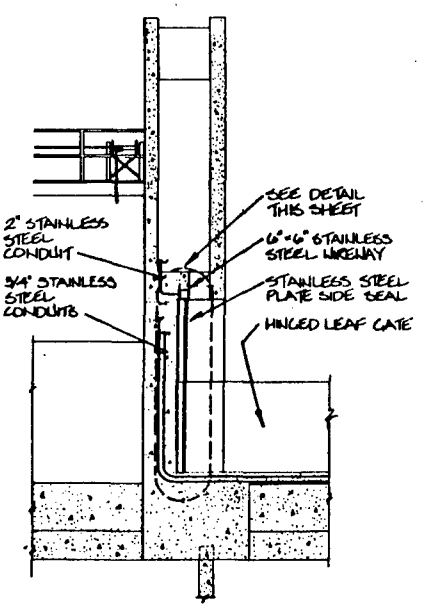
PANEL HV-1
CONNECTION DIAGRAM

RISER DIAGRAM

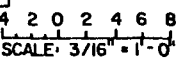


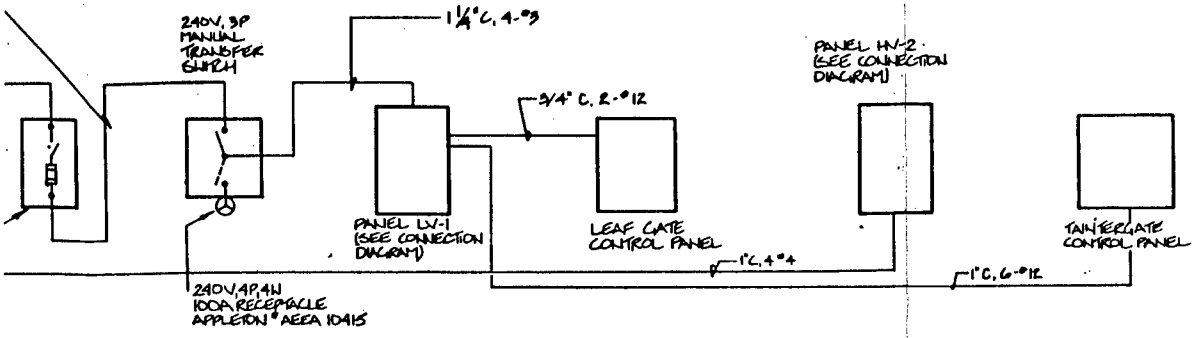
PIER 3 PLAN

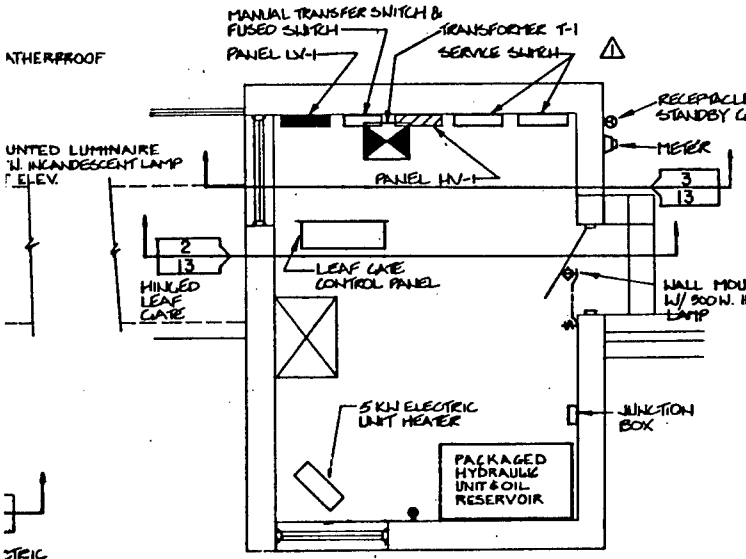




1/13 SECTION

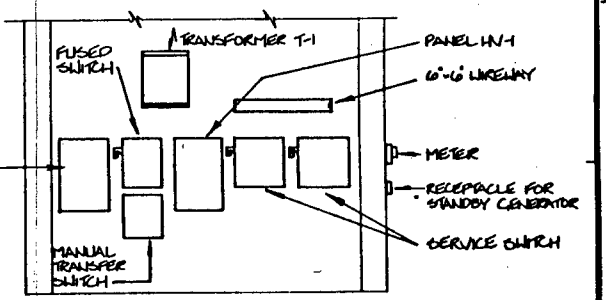






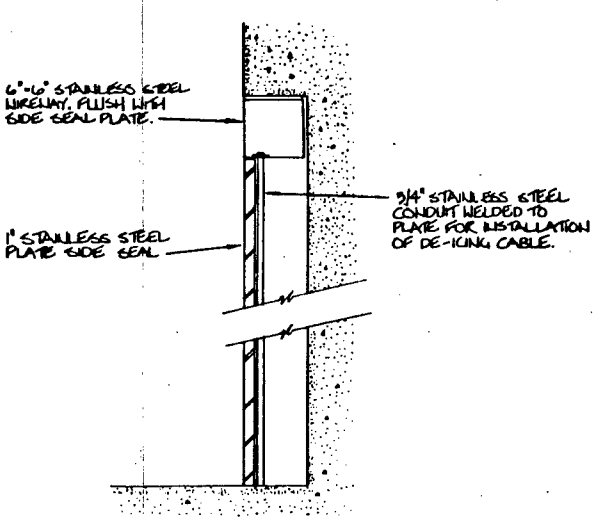
RIGHT ABUTMENT PLAN

SCALE: 3/8" = 1'-0"



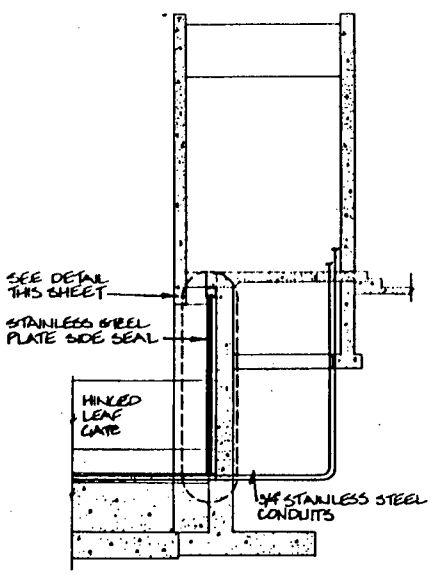
RIGHT ABUTMENT ELEVATION 3/13

SCALE: 3/8" = 1'-0"



DETAIL @ RIGHT ABUTMENT

OPPOSITE @ PIER 3



2/13 SECTION

SCALE: 3/16" = 1'-0"

SYMBOL	DESCRIPTION	DATE	APPROVAL
⚠	REVISED	NOV 88	G.V.F

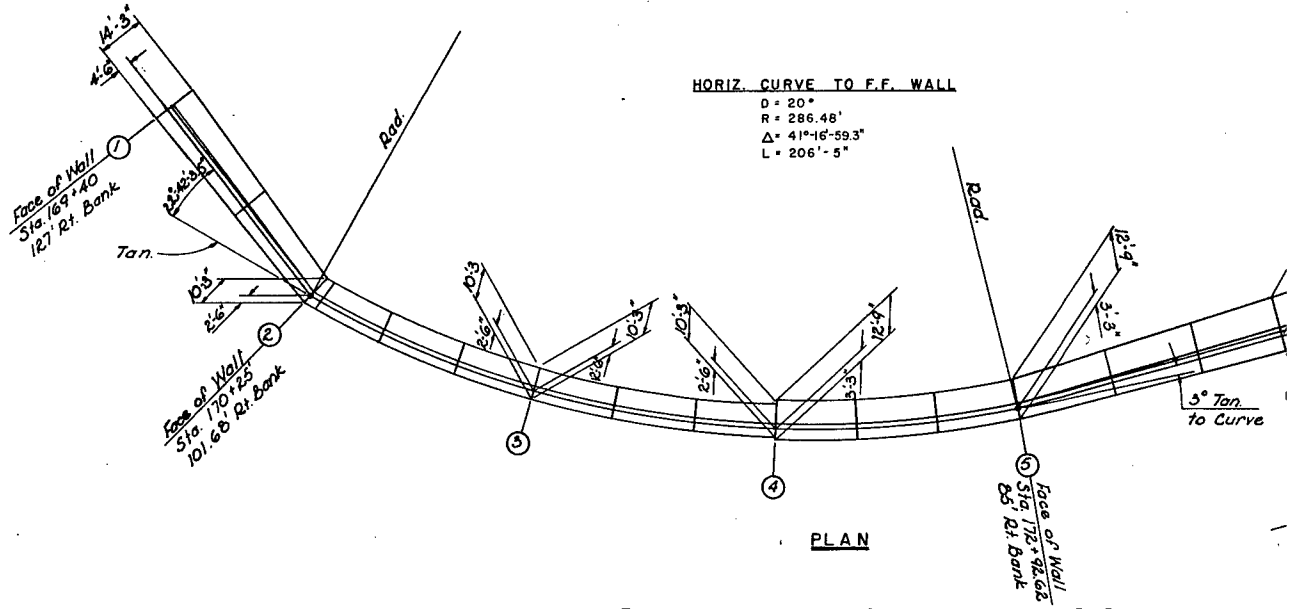
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: D.J.B.
DRAWN BY: P.J.B.
CHECKED BY: D.J.B.
SUBMITTED BY:

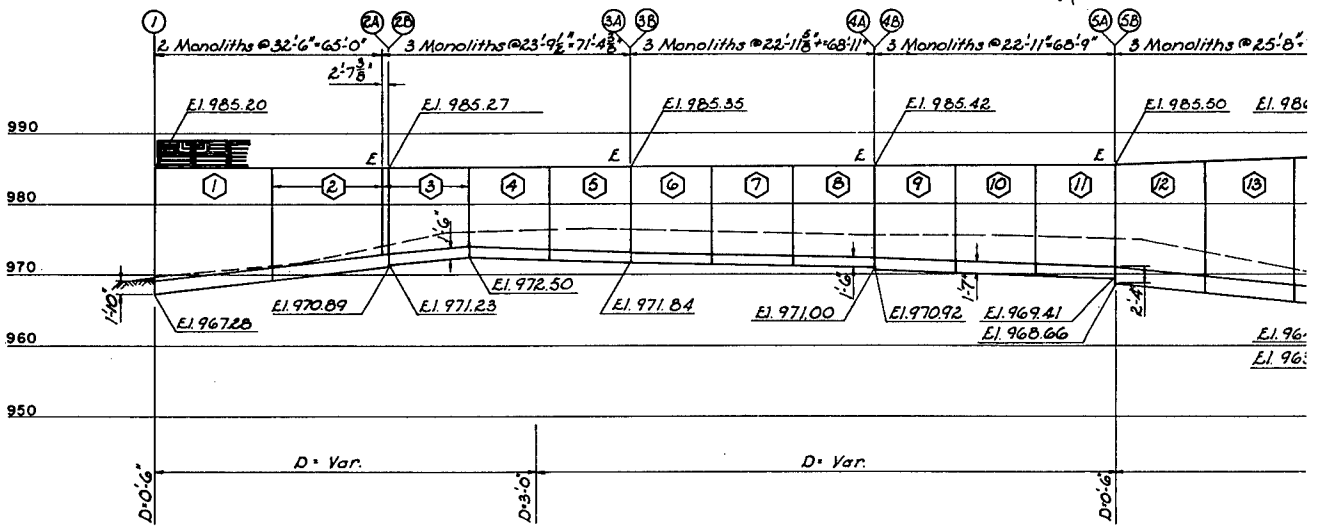
DESIGN MEMORANDUM NO. 2 . FEATURE
FLOOD CONTROL - SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
SILVER LAKE DAM

APPROVED BY:
DATE: JUNE 1985
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-40/13
SHEET 36 OF 45

PLATE 36



PLAN

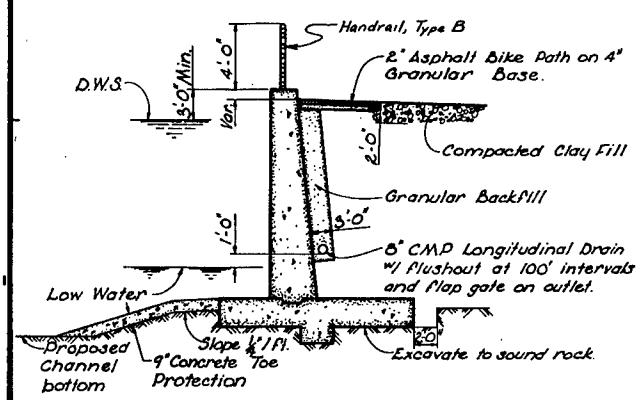


ELEVATION

HORIZONTAL DIMENSIONS ALONG FRONT FACE OF WALL

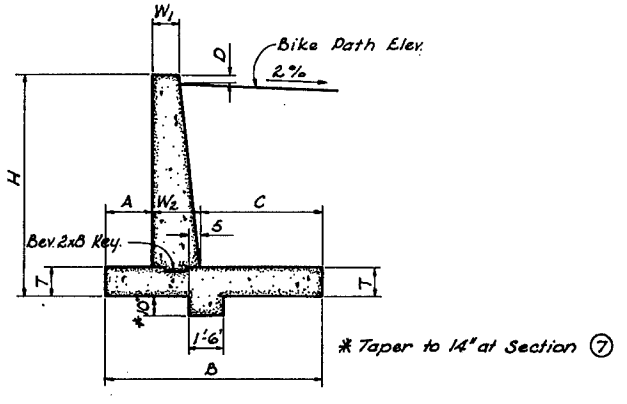
FLOOD WALL DIMENSION TABLE

	①	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	7	8
A	4'-6"	2'-6"	2'-6"	2'-6"	2'-6"	2'-6"	3'-3"	3'-3"	3'-3"	4'-4"	4'-4"	5'-6"	5'-0"
B	14'-3"	10'-3"	10'-3"	10'-3"	10'-3"	10'-3"	12'-9"	12'-9"	12'-9"	17'-6"	17'-6"	22'-6"	19'-3"
C	7'-11"	6'-3	6'-3"	6'-3"	6'-3"	6'-3"	8'-0"	7'-11"	7'-11"	10'-10"	10'-10"	13'-5"	11'-0"
H	17'-11"	14'-4½"	14'-0½"	13'-6"	13'-6"	14'-5"	14'-6"	16'-1"	16'-10"	22'-1"	23'-0"	28'-0½"	24'-8"
T	1'-10"	1'-10"	1'-6"	1'-6"	1'-6"	1'-6"	1'-7"	1'-7"	2'-4"	2'-4"	3'-3"	3'-3"	3'-3"
W_1	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"
W_2	1'-10"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-7"	1'-7"	2'-4"	2'-4"	3'-7"	3'-3"



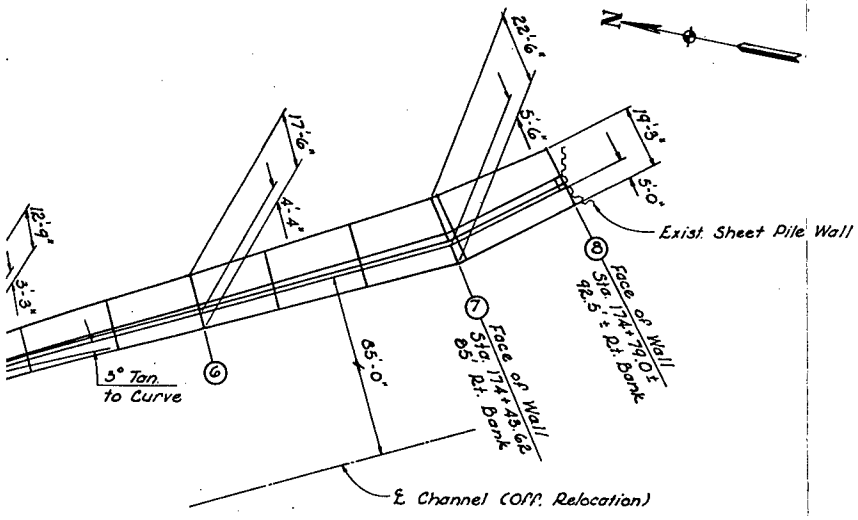
BACKFILL DETAIL

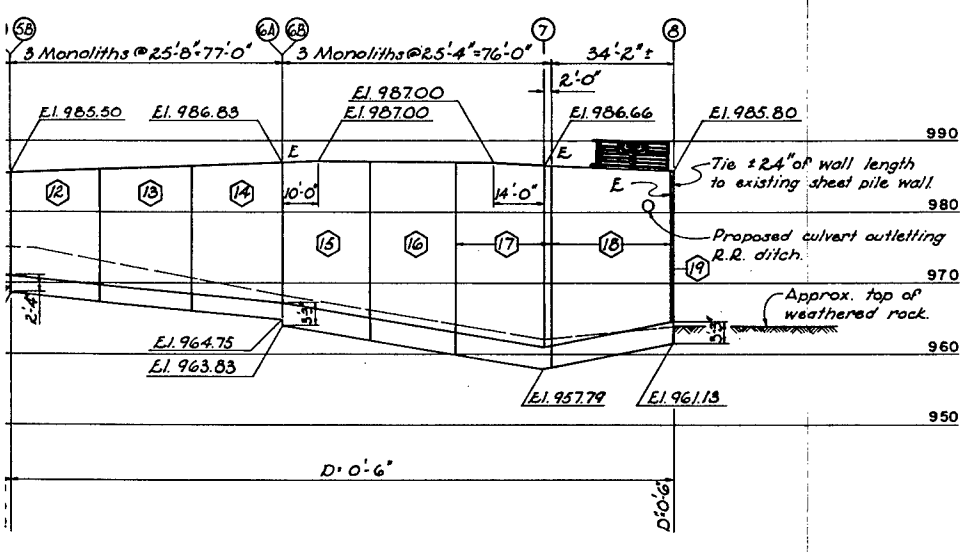
NO SCALE



TYPICAL SECTION

NO SCALE





ALL

4" at Section (7)

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS - Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

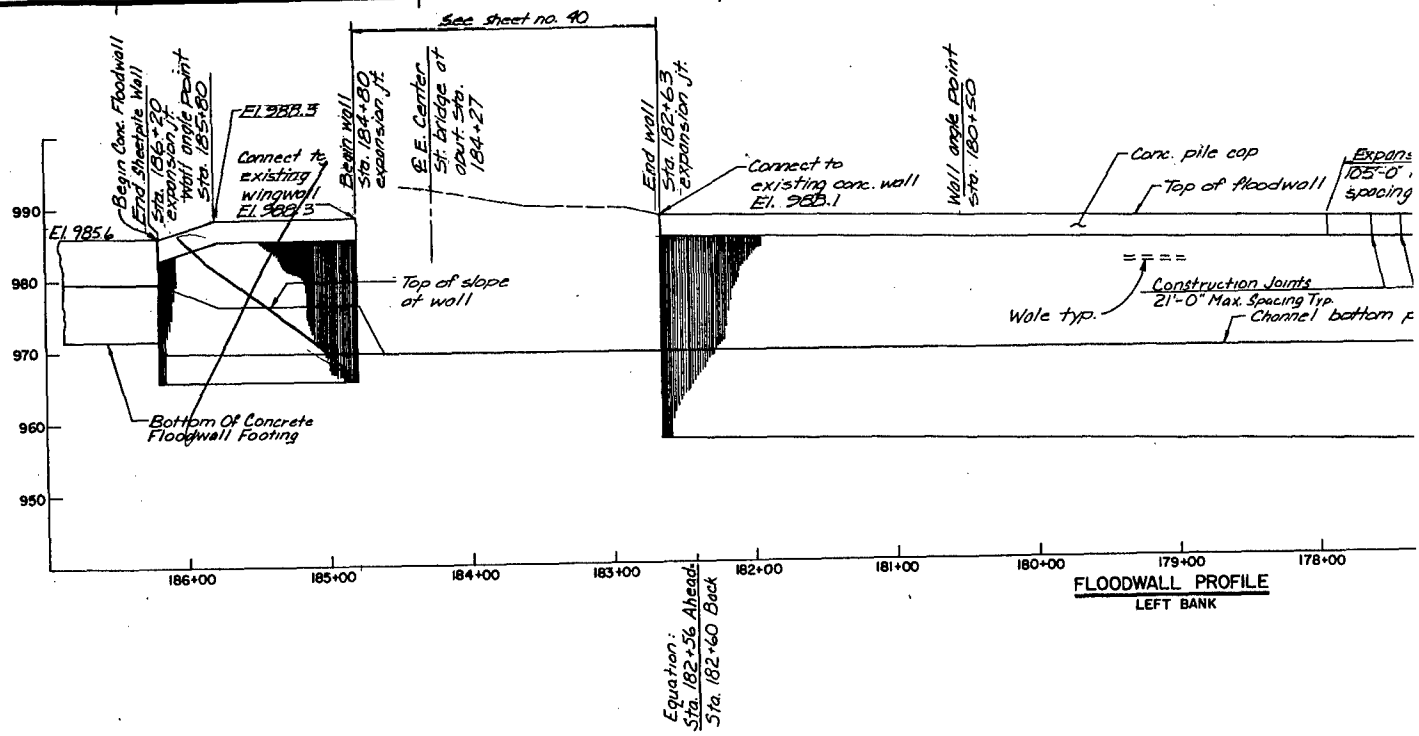
DESIGNED BY: C.E.W.
DRAWN BY: L.M.G.
CHECKED BY: G.E.G.
SUBMITTED BY: CHIEF ENGR. BRANCH / CHIEF ENGR. BRANCH

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
RIGHT BANK FLOODWALL
STA. 169+40 TO STA. 174+79

APPROVED BY: CHIEF ENGR. DIVISION
DATE: APRIL 1988
SCALE 1"=20' HOR. 1"=10' VERT.
SPEC. NO.
DRAWING NUMBER M30-R-61/6
SHEET 42 OF 51

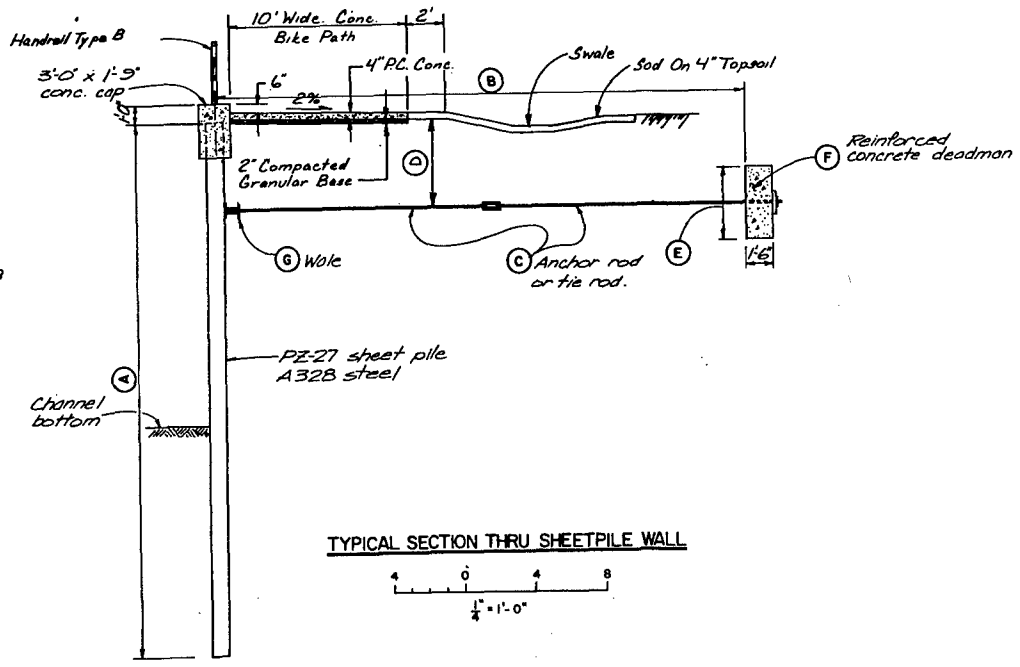
SAFETY PAYS

PLATE 42



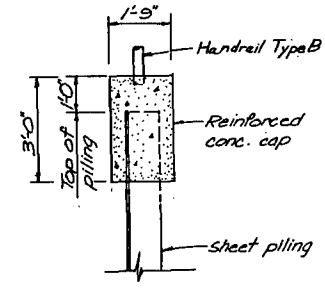
FLOODWALL PROFILE
LEFT BANK

Station		172+40 to 173+47	173+77 to 182+63	184+80 to 186+20
Length of sheet pile	A	41'-0"	30'-0"	22'-6"
Distance to deadman	B	42'-0"	30'-0"	21'-0"
Anchor type	C	2 3/4" ø upset to 3 1/4" ø	2" ø upset to 2 1/2" ø	2" ø upset to 2 1/2" ø
Depth to soil anchor	D	5'-0"	6'-0"	4'-0"
Depth of deadman	E	8'-0"	4'-0"	4'-0"
Type of deadman	F	Continuous	Continuous	Continuous
Top wale steel	G	2-C15 x 33.9	2-C10 x 20	2-C10 x 20
Anchor spacing		9'-0"	9'-0"	12'-0"



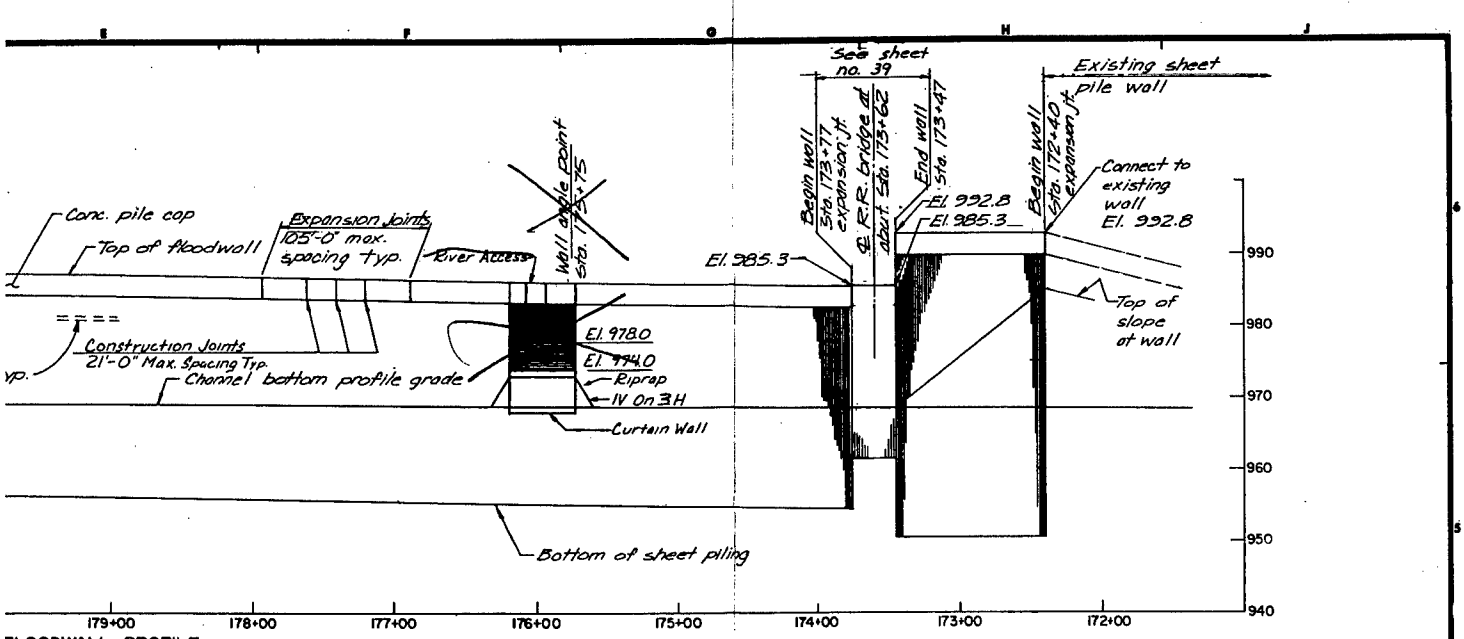
TYPICAL SECTION THRU SHEETPILE WALL

4 0 4 8
1" = 1'-0"



PILE CAP DETAIL

2 0 2 4
1/2" = 1'-0"



FLOODWALL PROFILE
LEFT BANK

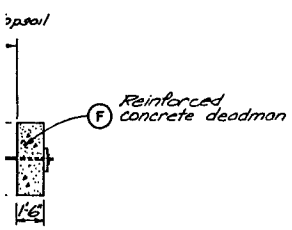
to 186+20
'-6"
0"
to 2½" ø
0°
0°
ous
x 20
0"

Notes:

Anchors to be upset to larger diameter at the anchor threads.

All anchors to be double corrosion protected, A36 steel

Block building at Sta 177+50 120' LT. to be removed.



SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. – Rochester, Minn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: J.A.J.
DRAWN BY: D.L.F./K.R.R.
CHECKED BY: J.D.S./D.O.
SUBMITTED BY:

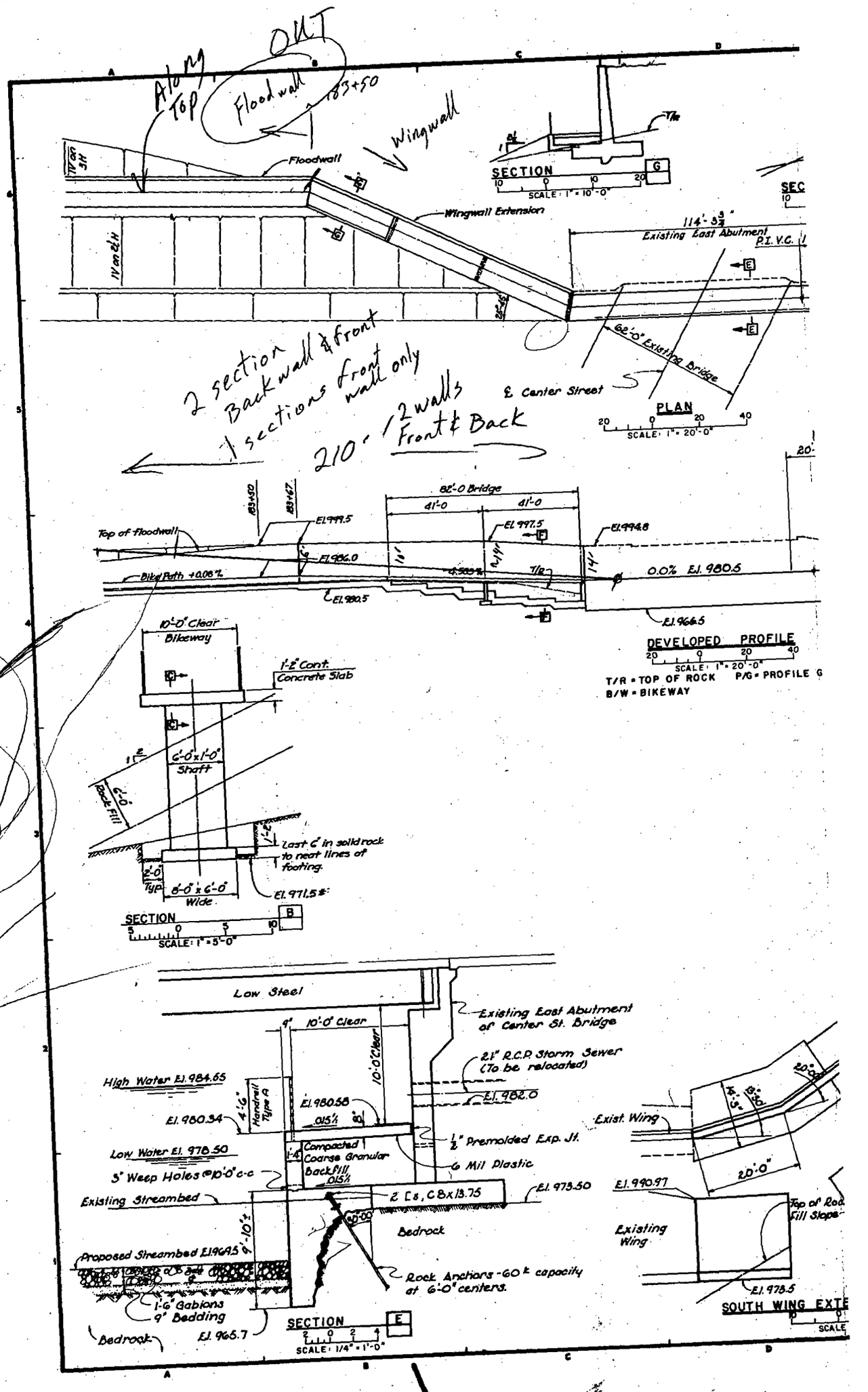
DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
LEFT BANK FLOODWALL
STA. 172+40 TO STA. 186+25

APPROVED BY:
DATE: APRIL 1988
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-61/7
SHEET 43 OF 51

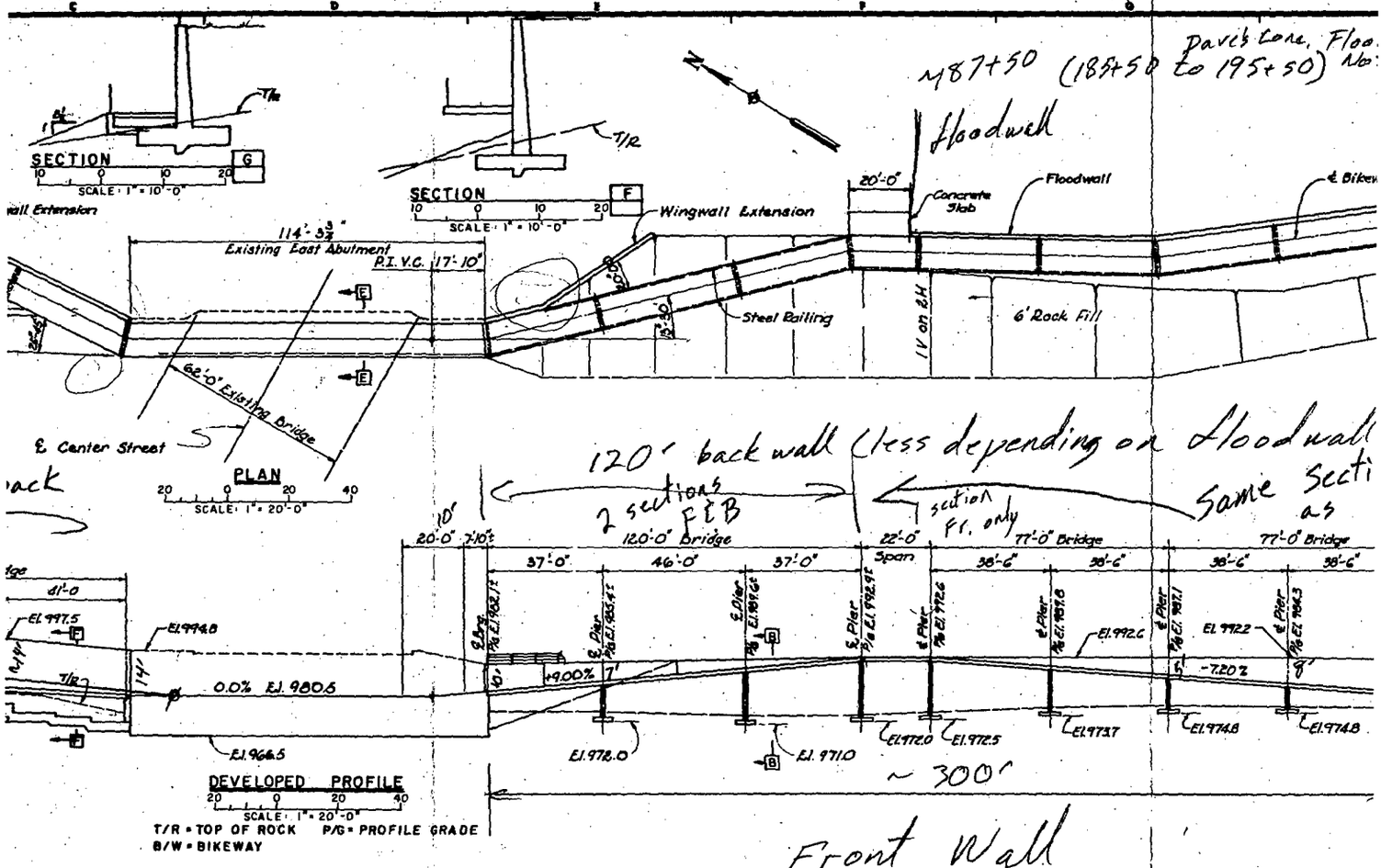
SAFETY PAYS

PLATE 43

2


Along Top Out
Floodwall
183+50
Wingwall
Floodwall
Wingwall Extension
SECTION
SCALE: 1" = 10'-0"
114'-5 3/4"
Existing East Abutment
P.I. V.C.
62'-0" Existing Bridge
2 section Backwall & Front
1 sections Front wall only
210' / 2 walls Front & Back
℄ Center Street
PLAN
SCALE: 1" = 20'-0"
183+30
183+67
82'-0 Bridge
41'-0
41'-0
El. 999.5
El. 997.5
El. 994.8
Top of Floodwall
El. 986.0
Bike Path +0.08%
0.0% El. 980.5
℄ El. 990.5
El. 966.5
DEVELOPED PROFILE
SCALE: 1" = 20'-0"
T/R = TOP OF ROCK P/G = PROFILE G
B/W = BIKEWAY
10'-0" Clear Bikeway
1'-2" Cont. Concrete Slab
6'-0" x 1'-0" Staff
6'-0" Rock Fill
Last 6' in solid rock to neat lines of footing.
2'-0" Typ
6'-0" x 6'-0" Wide
El. 971.5±
SECTION
SCALE: 1" = 5'-0"
Low Steel
Existing East Abutment of Center St. Bridge
9"
10'-0" Clear
10'-0" Clear
21" R.C.P. Storm Sewer (To be relocated)
High Water El. 984.65
El. 980.34
4'-6" Handrail Type A
El. 980.58
.015
8"
El. 982.0
Exist. Wing
1/2" Premolded Exp. Jt.
Low Water El. 978.50
1'-6"
Compacted Coarse Granular Backfill
.015
6 Mil Plastic
3" Weep Holes @ 10'-0" c-c
Existing Streambed
2 Ls, C8x13.75
El. 973.50
60°00
Bedrock
9'-10"±
Proposed Streambed El. 969.5
Rock Anchors - 60 k capacity at 6'-0" centers.
1'-6" Gabions
9" Bedding
Bedrock
El. 965.7
SECTION
SCALE: 1/4" = 1'-0"
El. 990.97
Existing Wing
El. 973.5
SOUTH WING EXTE
SCALE

400' – Existing Abutmen & Wingwalls 114'



M87+50 (185+50 to 195+50) Davis Lane, Floodwall No.

120' back wall (less depending on floodwall

2 sections FEB

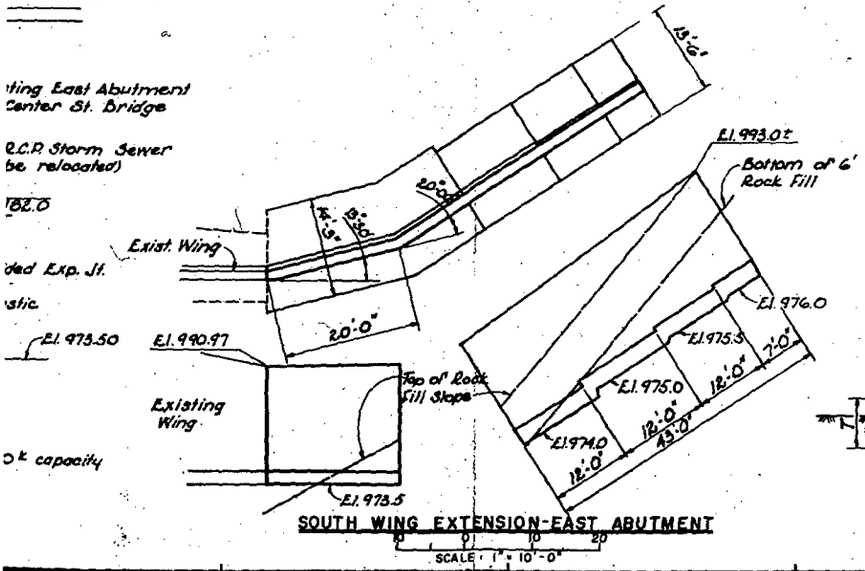
section Fl. only

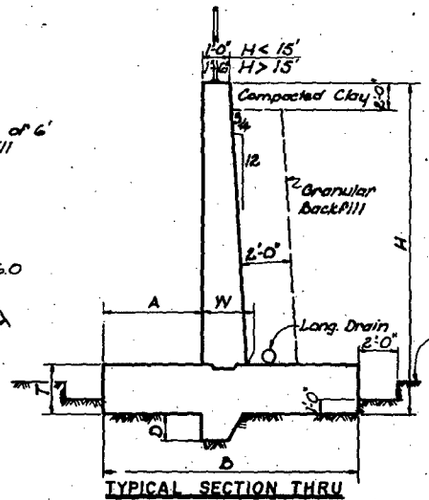
Same Section as

Front Wall

~ 300'

WALL DIMENSIONS						
H	B	A	T	W	D	
7'-0"	5'-9"	1'-3"	1'-6"	1'-5¼"	1'-0"	
9'-0"	7'-3"	1'-11"	1'-8"	1'-6¾"	1'-0"	
11'-0"	9'-0"	2'-7"	1'-9"	1'-8¼"	1'-0"	
13'-0"	10'-6"	3'-11"	1'-11"	1'-9¾"	1'-0"	
15'-0"	12'-3"	4'-4"	2'-7"	2'-5¼"	1'-0"	
17'-0"	13'-6"	4'-6"	2'-9"	2'-6¾"	1'-0"	
19'-0"	15'-0"	6'-4"	2'-11"	2'-8¼"	1'-0"	
21'-0"	16'-3"	6'-3"	3'-0"	2'-9¾"	1'-0"	
24'-0"	18'-6"	7'-3"	3'-2"	3'-0"	1'-0"	





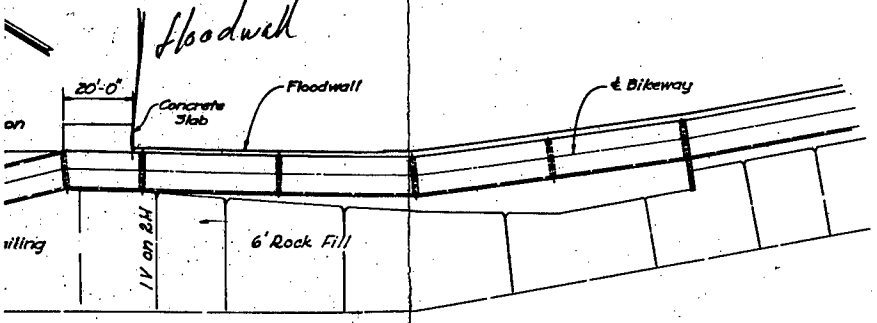
SAFETY PAYS

Existing Abutmen & Wingwalls 114' = 286' Tall wall

Davis Lane, Floodwall Notes

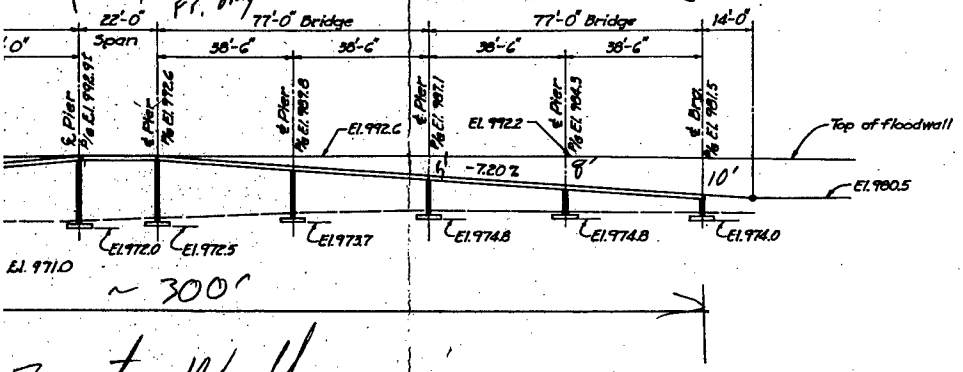
M87+50 (185+50 to 195+50)

Floodwall



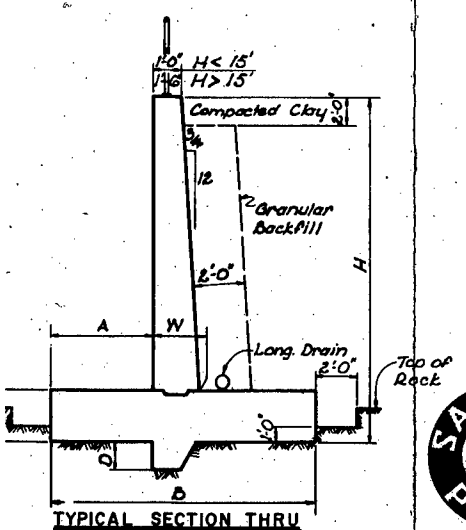
all (less depending on floodwall #1/5

Same Sections as (Floodwall incl. elsewhere)

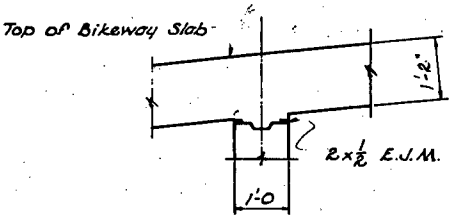


Front Wall

WALL DIMENSIONS						
H	B	A	T	W	D	
7'-0"	5'-9"	1'-3"	1'-6"	1'-3½"	1'-0"	
9'-0"	7'-3"	1'-11"	1'-8"	1'-6¾"	1'-0"	
11'-0"	9'-0"	2'-7"	1'-9"	1'-8¼"	1'-0"	
13'-0"	10'-6"	3'-11"	1'-11"	1'-9¾"	1'-0"	
15'-0"	12'-3"	4'-4"	2'-7"	2'-5¼"	1'-0"	
17'-0"	13'-6"	4'-6"	2'-9"	2'-6¾"	1'-0"	
19'-0"	15'-0"	6'-4"	2'-11"	2'-8¾"	1'-0"	
21'-0"	16'-3"	6'-5"	3'-0"	2'-9¾"	1'-0"	
24'-0"	18'-6"	7'-3"	3'-2"	3'-0"	1'-0"	



TYPICAL SECTION THRU WINGWALL EXTENSIONS
NO SCALE



SECTION C
SCALE: 3/4" = 1'-0"

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS - Professional Engineers & Planners
Mason City, Ia. - Rochester, Mn. - Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: G.E.G.
DRAWN BY: L.M.G.
CHECKED BY: C.E.W.
SUBMITTED BY:
APPROVED BY: Robert L. Pat

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
BIKE PATH UNDERPASS
CENTER STREET BRIDGE

DATE: APRIL 1988
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-61/9
SHEET 45 OF 51

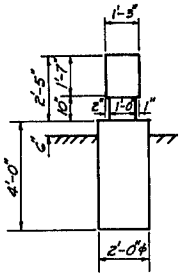
SAFETY PAYS

3

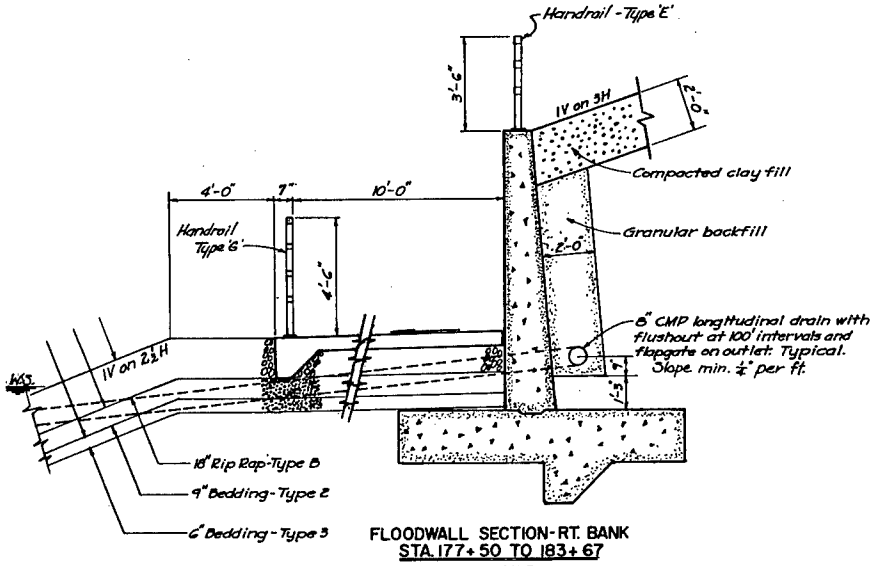
PLATE 45

FLOODWALL DIMENSIONS RT. BANK		
STATION	177+50 to 183+45	183+45 to 183+67
A	4'-0"	2'-6"
B	10'-9"	10'-0"
C	5'-3½"	5'-5"
H	12'-9"	16'-0"
T	2'-0"	2'-0"
W1	1'-0"	1'-6"
W2	1'-5½"	2'-1"
KEY	YES	—

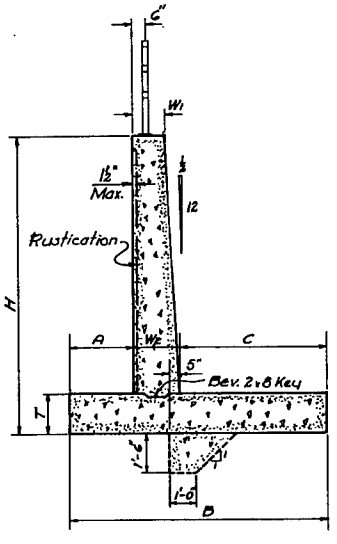
FLOODWALL DIMENSIONS - RT. BANK									
STATION	187+45 to 187+70	187+70 to 187+97	187+97 to 188+17	188+17 to 188+37	188+37 to 188+61	188+61 to 189+00	189+00 to 190+00	190+00 to 193+13	193+13 to 193+45
A	1'-9"	3'-0"	2'-0"	2'-6"	2'-6"	2'-0"	2'-6"	2'-0"	3'-0"
B	6'-5"	9'-0"	13'-0"	10'-0"	10'-0"	18'-0"	10'-0"	10'-0"	9'-0"
C	3'-2"	4'-7"	9'-0"	5'-5"	5'-4"	13'-9"	5'-5½"	6'-0"	4'-7"
H	9'-3"	11'-6"	13'-9"	16'-0"	17'-9"	19'-6"	15'-3"	14'-3"	11'-0"
T	1'-3"	1'-6"	2'-0	2'-0"	2'-0"	2'-0"	2'-0"	1'-9"	1'-3"
W1	1'-0"	1'-0"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-0"
W2	1'-4"	1'-5"	2'-0"	2'-1"	2'-2"	2'-3"	2'-0½"	2'-0"	1'-5"
KEY	—	—	—	—	—	—	—	—	—



SECTION A
NO SCALE



FLOODWALL SECTION - RT. BANK
STA. 177+50 TO 183+67
NO SCALE

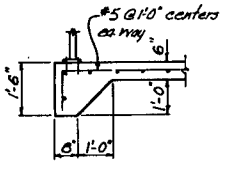


FLOODWALL DIMENSIONS
(SEE TABLES)
NO SCALE

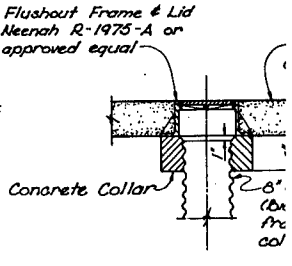
Form liner used at walls for rustication shall be approved by the City of Rochester.

Flap G

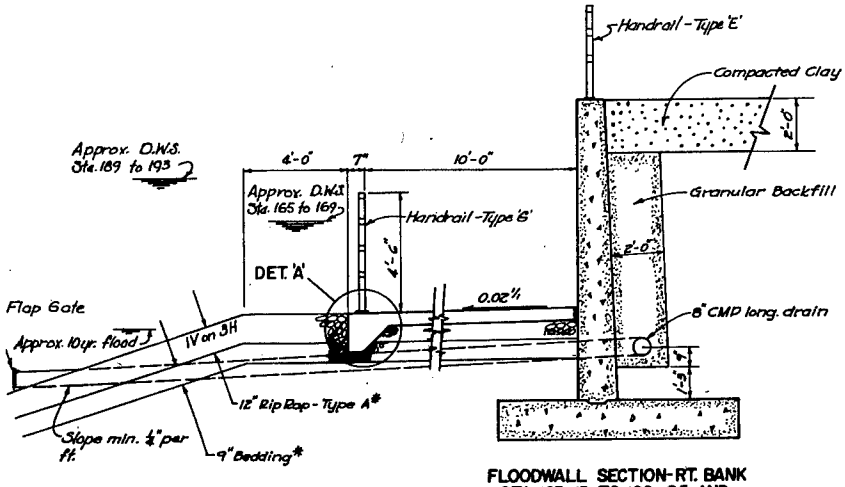
FLOODWALL DIMENSIONS - RT. BANK					
STATION	165+15 to 165+38	165+38 to 165+65	165+65 to 168+40	168+40 to 168+75	168+75 to 169+05
A	1'-0"	1'-9"	3'-0"	1'-9"	1'-0"
B	5'-6"	6'-3"	9'-0"	6'-3"	5'-6"
C	3'-2½"	3'-1½"	4'-6½"	3'-1½"	3'-2½"
H	8'-0"	10'-0"	12'-6"	10'-3"	8'-0"
T	1'-3"	1'-3"	1'-6"	1'-3"	1'-3"
W1	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
W2	1'-3½"	1'-4½"	1'-5½"	1'-4½"	1'-3½"
KEY	—	—	—	—	—



DETAIL 'A'

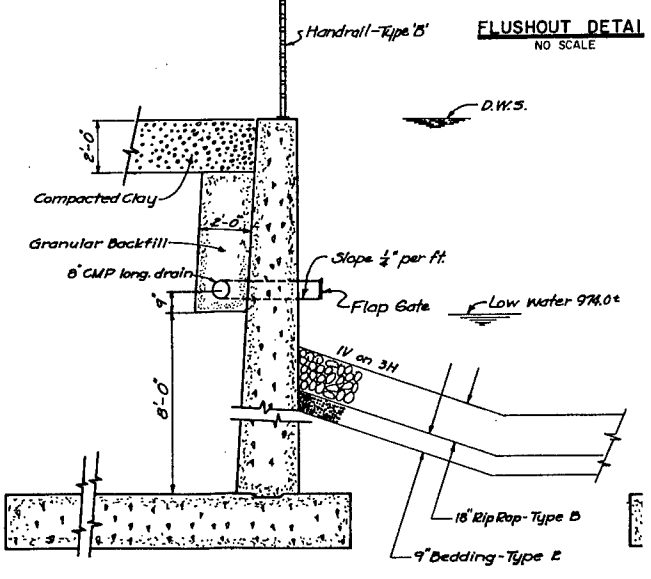


FLUSHOUT DETAIL
NO SCALE

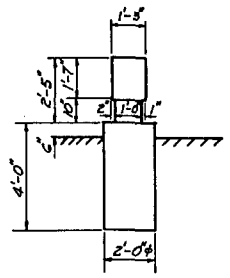


FLOODWALL SECTION - RT. BANK
STA. 165+15 TO 169+05 AND
STA. 189+00 TO 193+45
NO SCALE

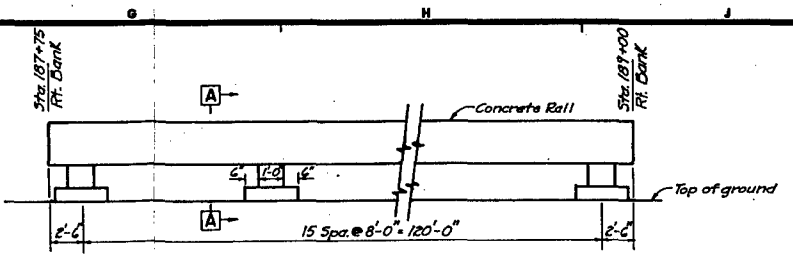
* 6' Rockfill From Sta. 189+00 to 193+45



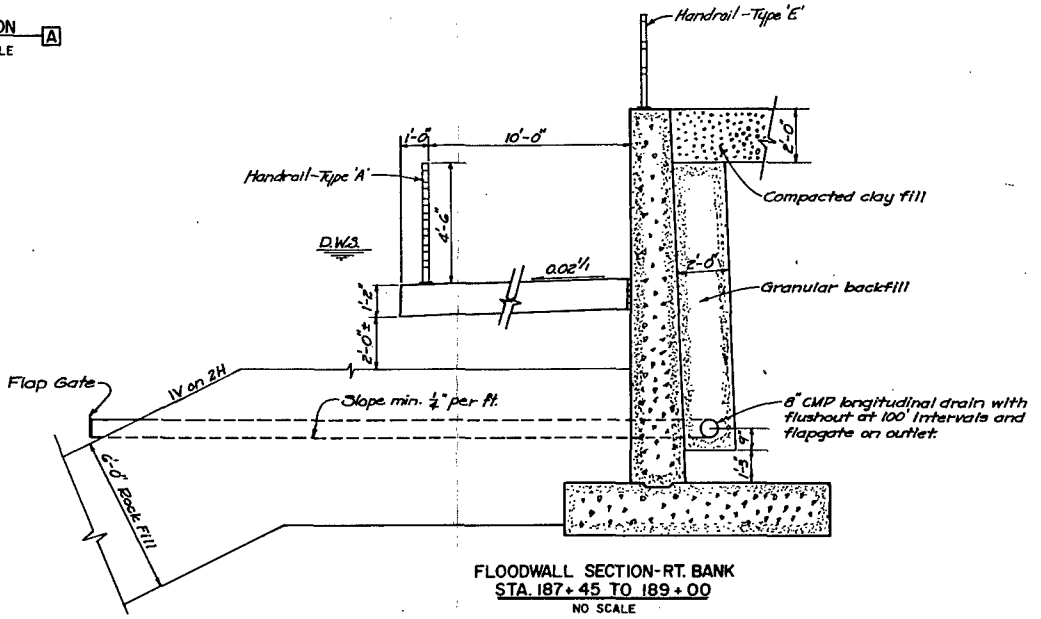
FLOODWALL SECTION - LT. BANK
STA. 192+32 TO 198+67
NO SCALE



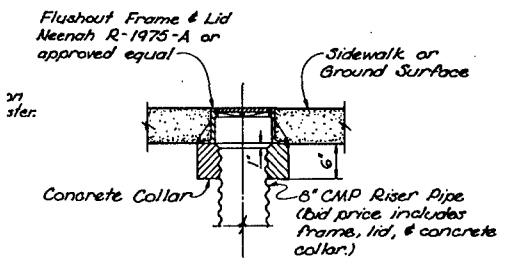
SECTION A
NO SCALE



ELEVATION OF TRAFFIC RAILING
NO SCALE

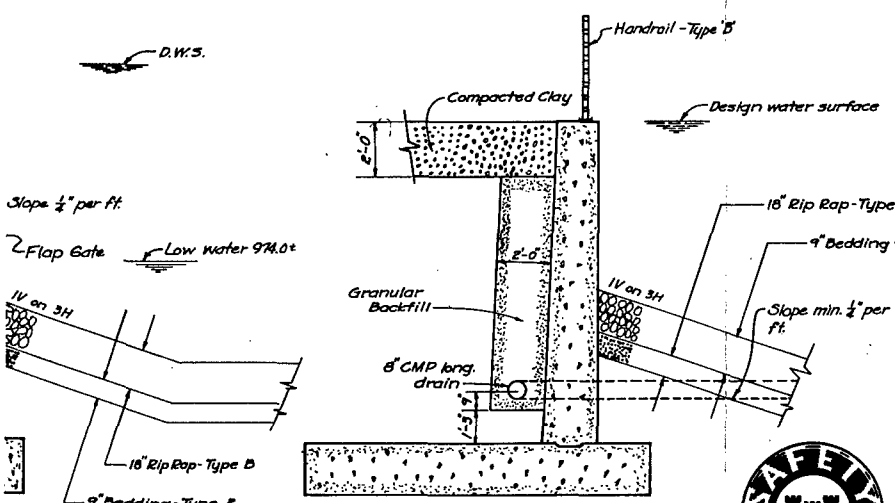


FLOODWALL SECTION-RT. BANK
STA. 187+45 TO 189+00
NO SCALE



FLUSHOUT DETAIL
NO SCALE

FLOODWALL DIMENSIONS - LT. BANK											
STATION	186+20 to 191+00	191+00 to 191+65	191+65 to 192+32	192+32 to 193+00	193+00 to 196+00	196+00 to 198+00	198+00 to 198+67	198+67 to 199+33	199+33 to 200+00	200+00 to 202+45	202+45 to 202+90
A	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"
B	13'-0"	16'-0"	16'-10"	18'-0"	18'-5"	18'-0"	17'-10"	16'-10"	16'-0"	13'-0"	16'-0"
C	9'-0"	11'-11"	12'-8"	13'-8½"	14'-0"	13'-8½"	13'-7"	12'-8"	11'-11"	9'-0"	11'-11"
H	14'-0"	16'-0"	18'-0"	21'-0"	22'-0"	21'-0"	20'-0"	18'-0"	16'-0"	14'-0"	16'-0"
T	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"	2'-0"
W1	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"
W2	2'-0"	2'-1"	2'-2"	2'-3½"	2'-5"	2'-3½"	2'-3"	2'-2"	2'-1"	2'-0"	2'-1"
KEY	—	—	—	—	—	—	—	—	—	—	—



FLOODWALL SECTION-LT. BANK
STA. 186+20 TO 192+32 AND
STA. 198+67 TO 203+00
NO SCALE

SAFETY PAYS

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS - Consulting Engineers & Planners
Mason City, Ia.-Dubuque, Ia.-Rochester, Mn.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: C.E.W.
DRAWN BY: L.M.G.
CHECKED BY: G.E.G.
SUBMITTED BY:
CHIEF BRANCH
CHIEF BRANCH

DESIGN MEMORANDUM NO.2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B
FLOODWALL DETAILS
TRAFFIC RAILING
CONCRETE BIKE PATH

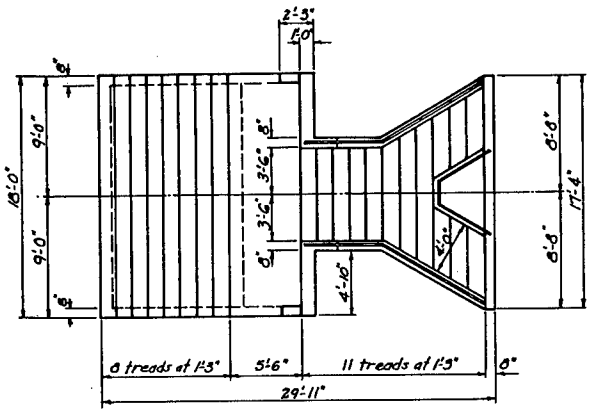
APPROVED BY:
CHIEF, ENGR. DIVISION

DATE: APRIL 1988

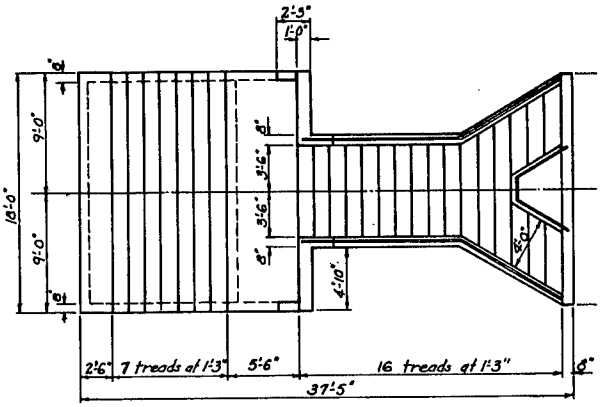
SCALE: AS SHOWN
SPEC. NO.

DRAWING NUMBER
M30-R-61/10
SHEET 46 OF 51

PLATE 46



PLAN



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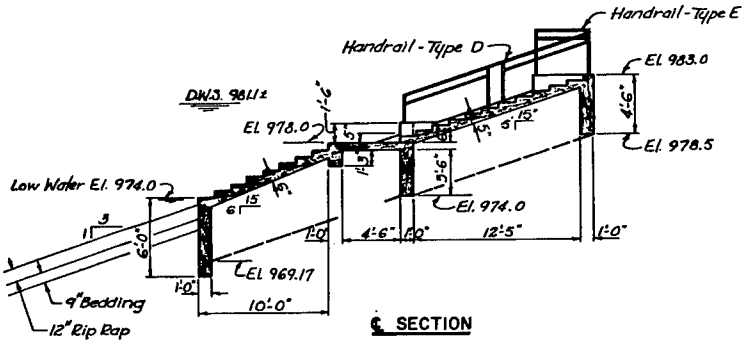
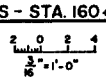
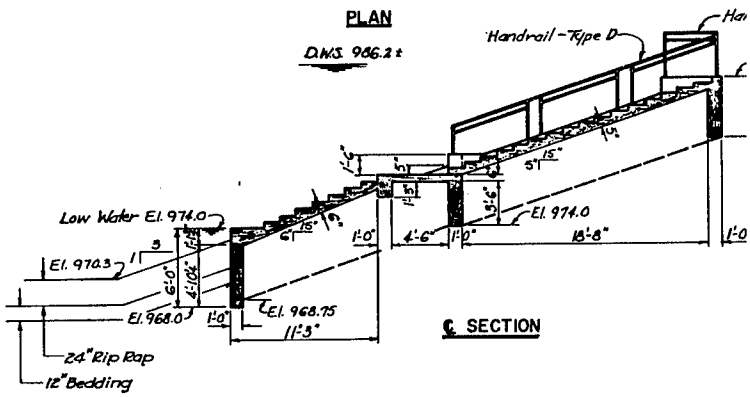


℄ SECTION

RIVER ACCESS - STA. 160+30 LT. BANK

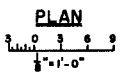


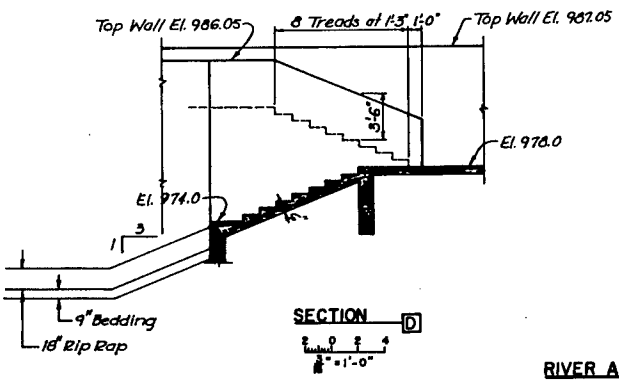


℄ SECTION

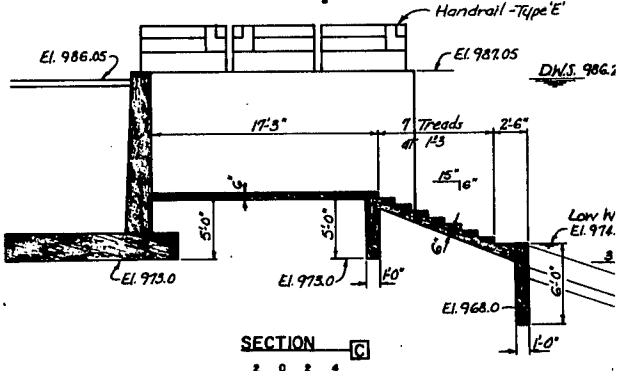
RIVER ACCESS - STA. 195+20 RT. BANK

PLAN

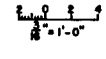




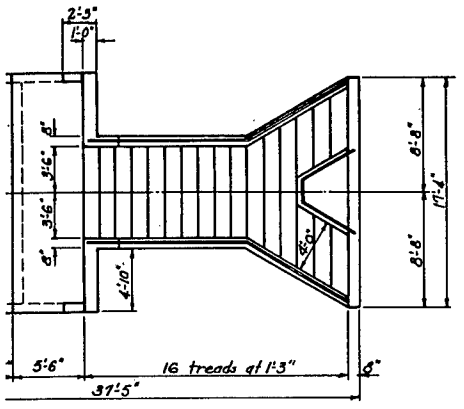
SECTION D

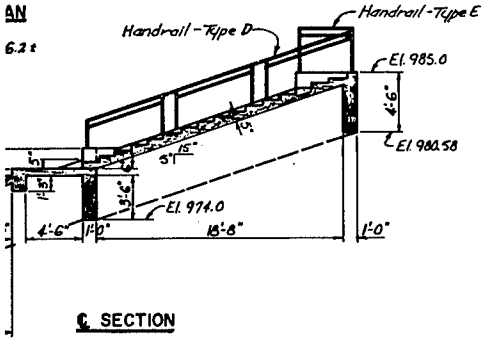


SECTION C



RIVER ACCESS - STA. 196+00 LT. BANK



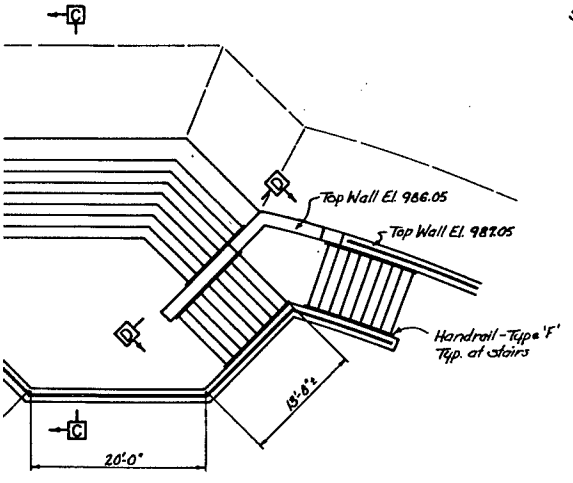


AN

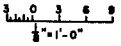
6.2 ±

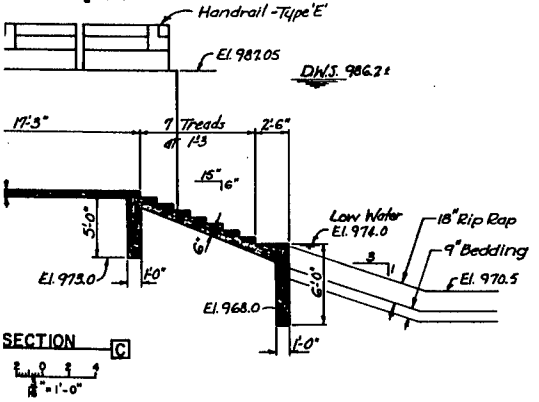
℄ SECTION

ACCESS - STA. 195+20 RT. BANK

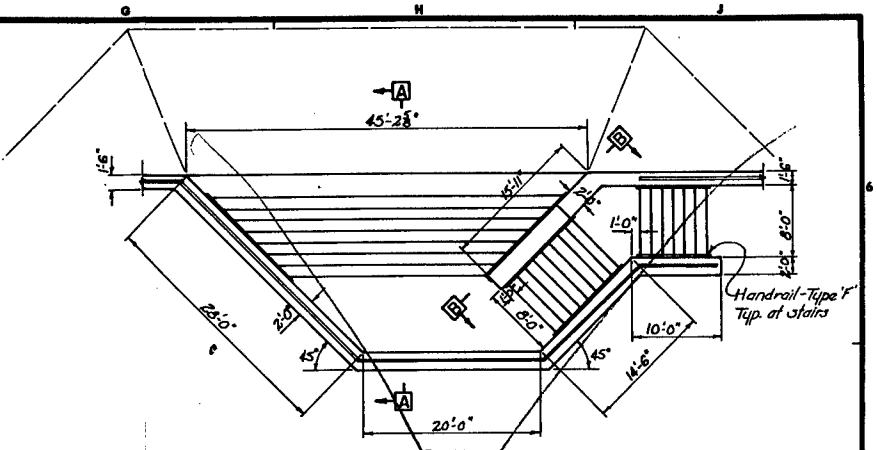


PLAN

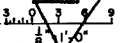


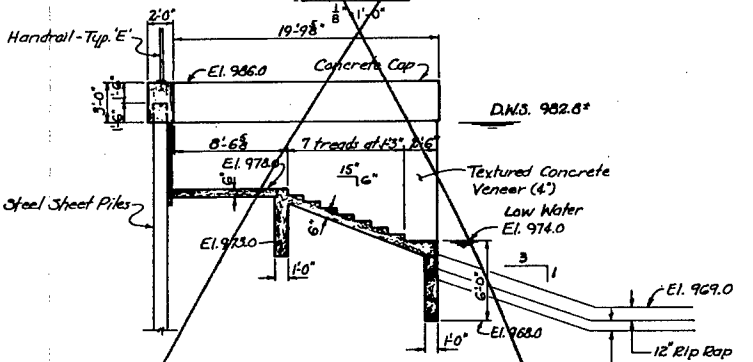


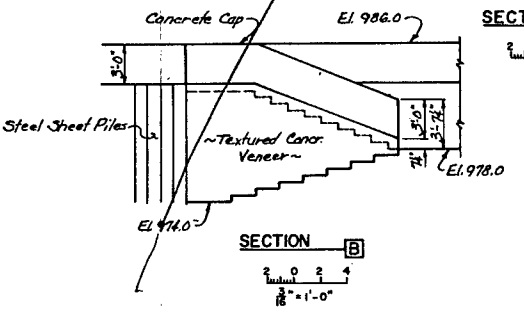
SECTION



PLAN

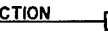


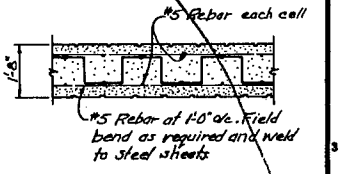




SECTION B

SECTION A





VENEER DETAIL - BOTH SIDES

RIVER ACCESS - STA. 176+00 LT. BANK

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS - Consulting Engineers & Planners
Mason City, Ia. - Dubuque, Ia. - Rochester, Mn.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: G.E.G.
DRAWN BY: L.M.G.
CHECKED BY: C.E.W.
SUBMITTED BY:
CHIEF BRANCH
APPROVED BY:
CHIEF ENGR. DIVISION

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA

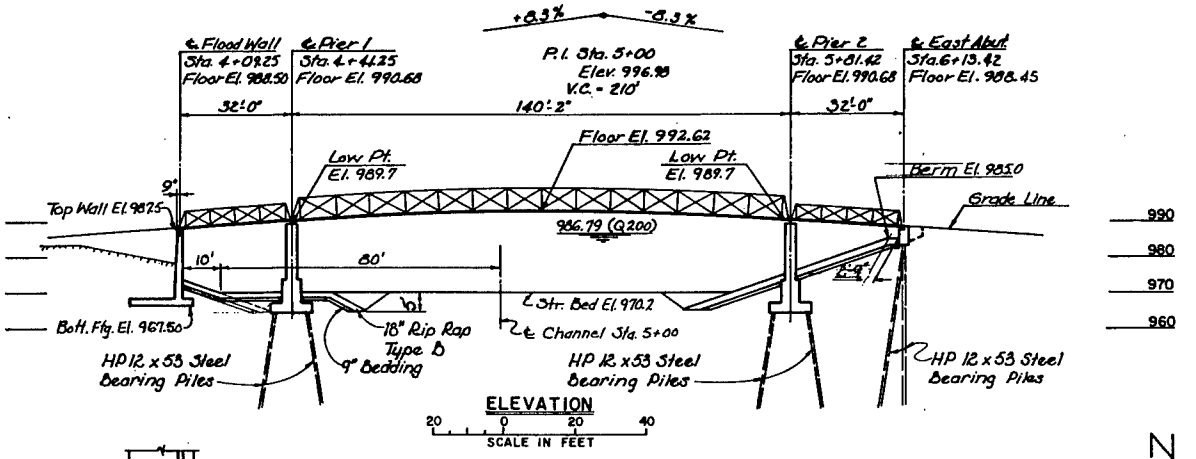
STAGE 1B
RIVER ACCESSES - STA. 195+20 RT. BANK
STA. 160+30, 176+00, and 196+00 LT. BANK

DATE: APRIL 1988
SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER: M30-R-61/11
SHEET 47 OF 51

SAFETY DAYS

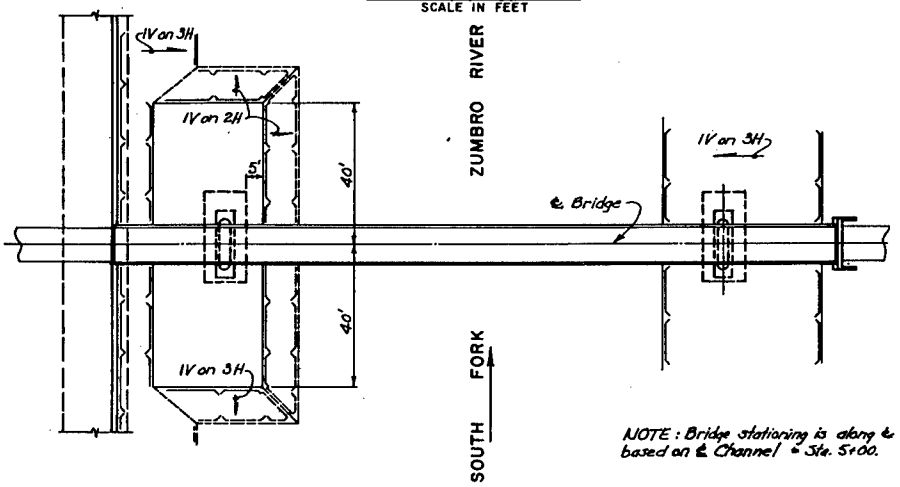
PLATE 47

2



ELEVATION

SCALE IN FEET 20 0 20 40

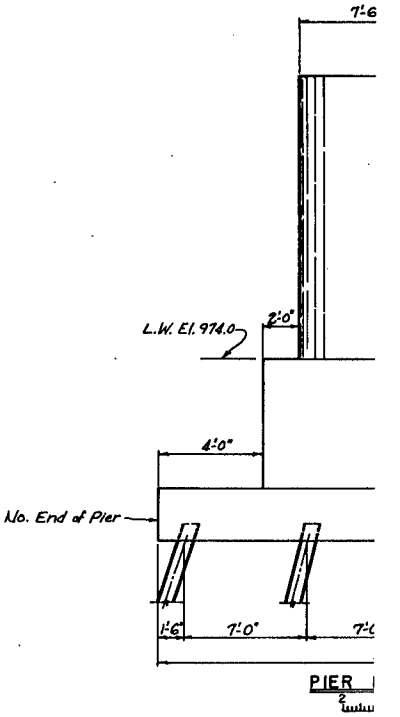


NOTE: Bridge stationing is along ℄ of bridge based on ℄ Channel ⌀ Sta. 5+00.

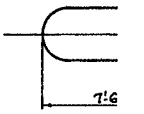
PLAN

SCALE IN FEET 20 0 20 40

N



PIER



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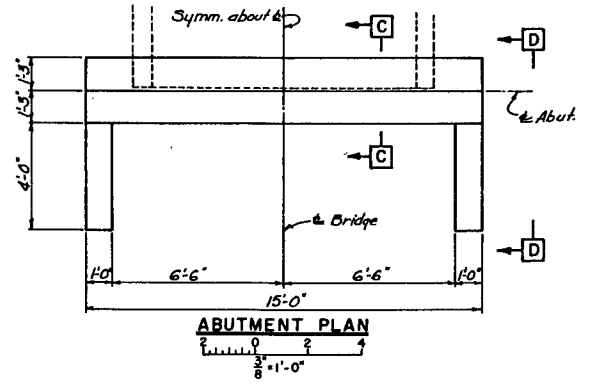
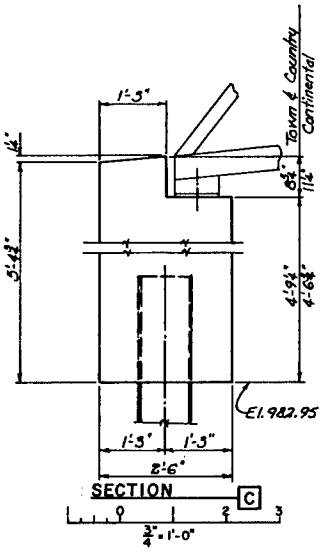


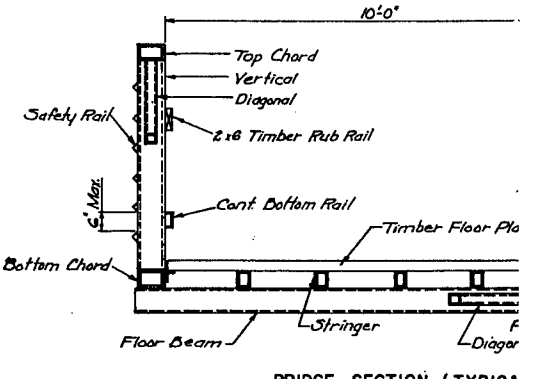
ABUTMENT PLAN

3/8" = 1'-0"



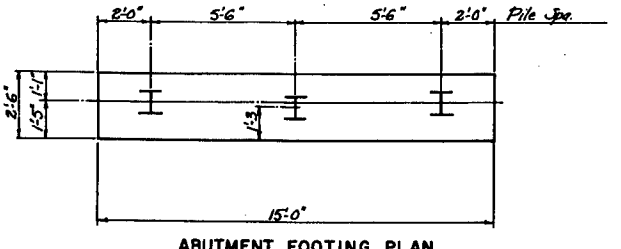
SECTION

3/4" = 1'-0"



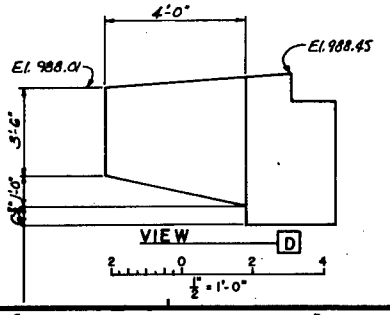
BRIDGE SECTION (TYPICA

NO SCALE



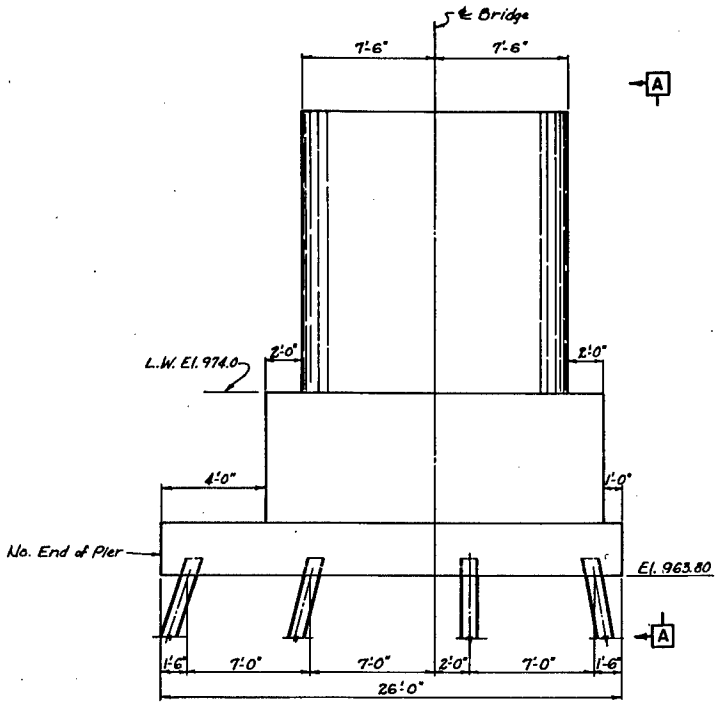
ABUTMENT FOOTING PLAN

3/8" = 1'-0"



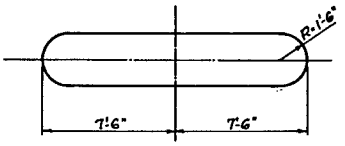
VIEW

1/2" = 1'-0"



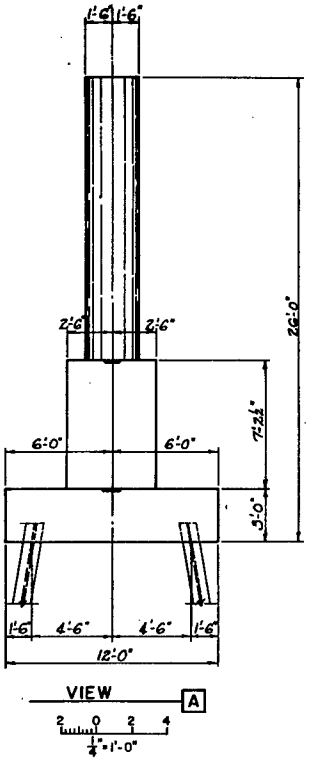
PIER ELEVATION

2 0 2 4
1/4" = 1'-0"



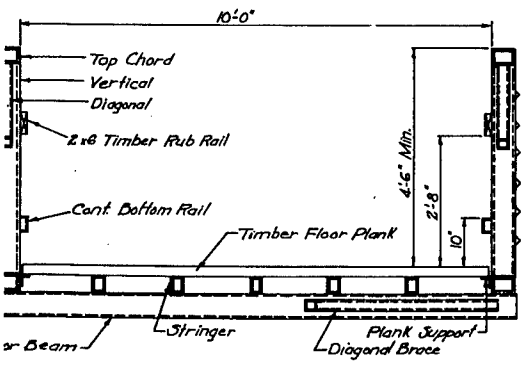
PLAN OF CAP

2 0 2 4
1/4" = 1'-0"



VIEW A

2 0 2 4
1/4" = 1'-0"



BRIDGE SECTION (TYPICAL)
NO SCALE

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS - Consulting Engineers & Planners
Mason City, Ia. - Dubuque, Ia. - Rochester, Mn.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: C.E.W.
DRAWN BY: L.M.G.
CHECKED BY: G.E.G.
SUBMITTED BY:

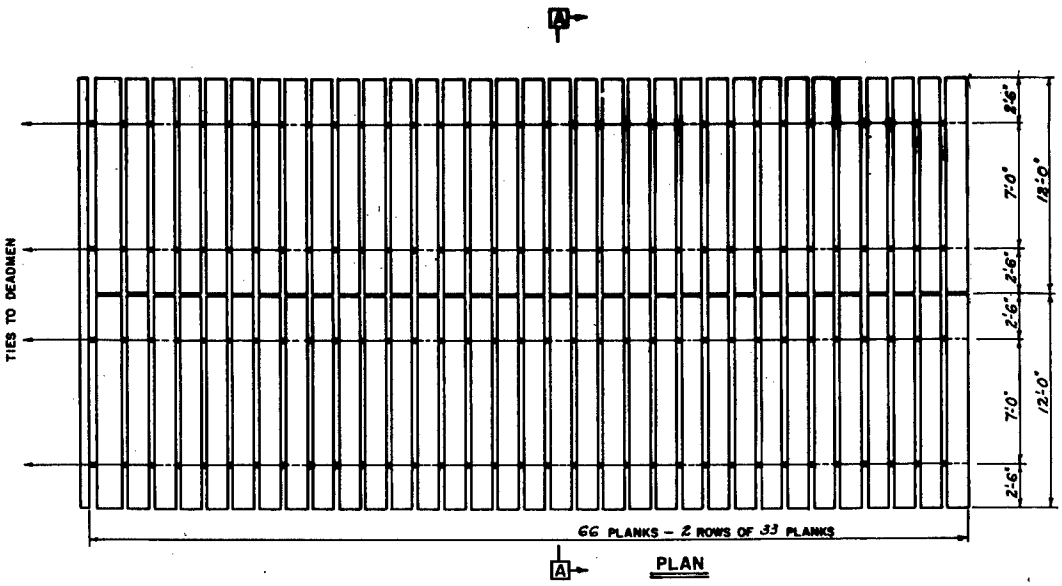
DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
BICYCLE & PEDESTRIAN BRIDGE
STA. 194 + 00

APPROVED BY:
DATE: APRIL 1988

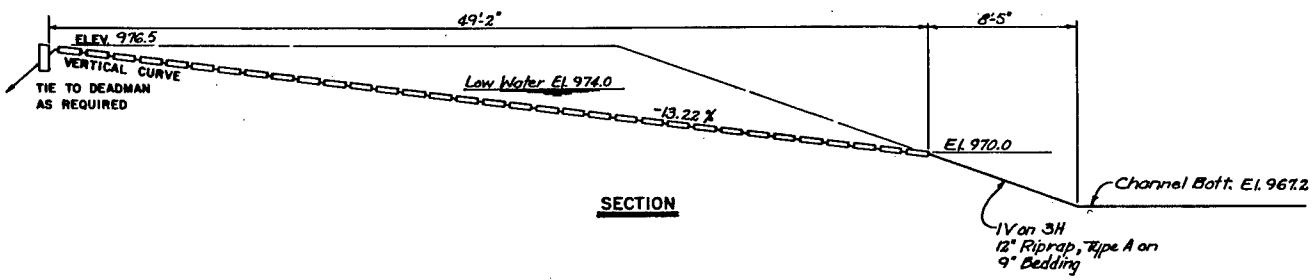
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-61/12
SHEET 48 OF 51

SAFETY DAYS

PLATE 48

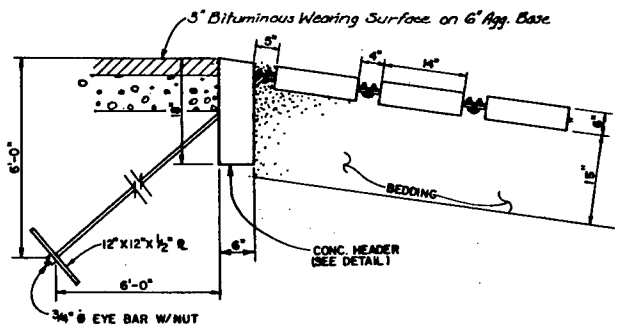


PLAN



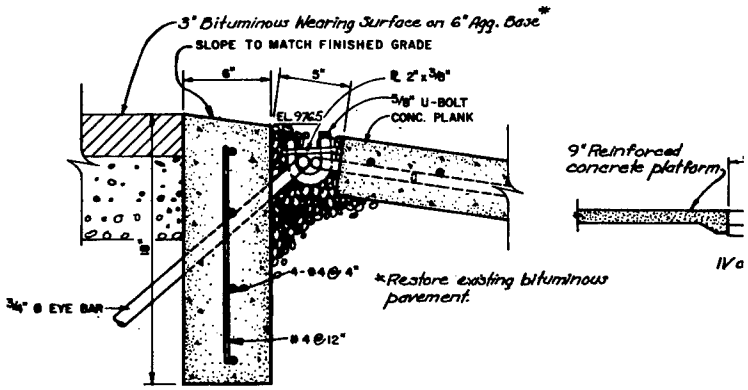
SECTION

4 0 4
SCALE IN FEET



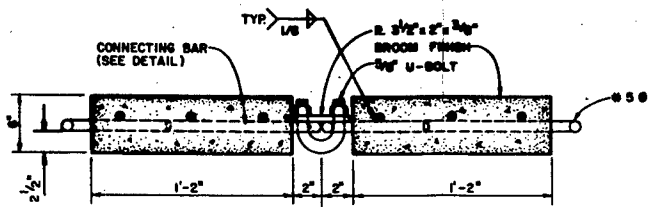
DEADMAN DETAIL

1 0 1 2
SCALE IN FEET



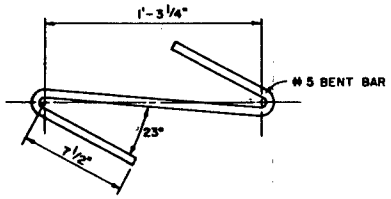
HEADER DETAIL

5 0 5
SCALE IN INCHES



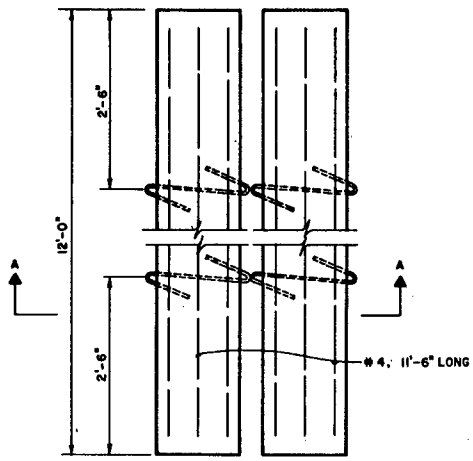
SECTION A-A

5 0 5
SCALE IN INCHES



CONNECTING BAR

5 0 5
SCALE IN INCHES



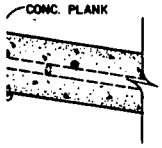
REINFORCEMENT DETAIL

0 1 2
SCALE IN FEET

Channel Bott. El. 967.2

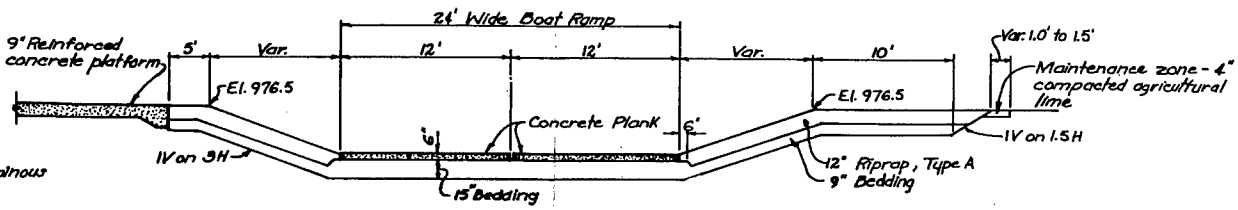
A on

urface on 6" Agg. Base*
:D GRADE
— 2" x ⅜"
⅝" U-BOLT
CONC. PLANK



*Restore existing bituminous pavement.

NOTE: CONNECTING BAR, EYE BAR, PLATES, NUTS AND U-BOLTS SHALL BE GALVANIZED.



SECTION A

5 0 5
SCALE IN FEET

SYMBOL	DESCRIPTION	DATE	APPROVAL

WYNN – Professional Engineers & Planners
Mason City, Ia. – Rochester, Mn. – Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: D.G.
DRAWN BY: L.M.S.
TRACED BY: C.E.W.
SUBMITTED BY:
CHIEF, DESIGN BRANCH

DESIGN MEMORANDUM NO.2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
BOAT RAMP DETAILS
STA. 156+40 L.T. BANK

APPROVED:
CHIEF, ENGR. DIVISION

APPROVED BY:

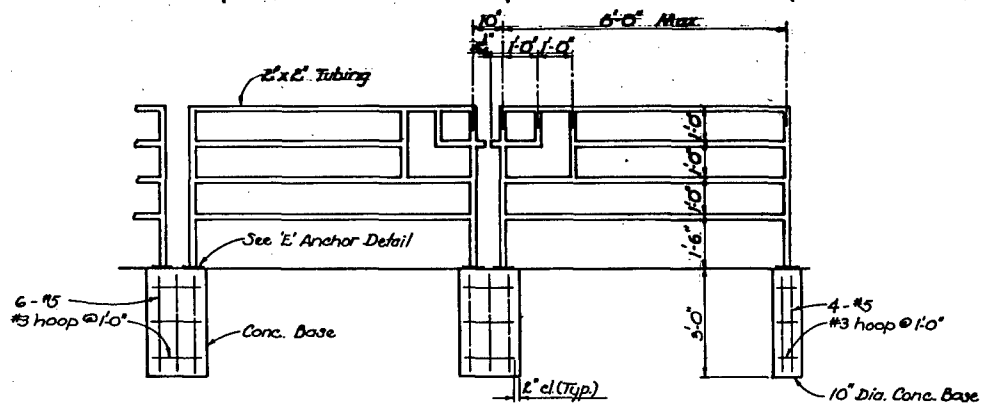
DATE: APRIL 1968

SCALE: AS SHOWN
SPEC. NO.

DRAWING NUMBER
M30-R-61/13
SHEET 49 OF 51

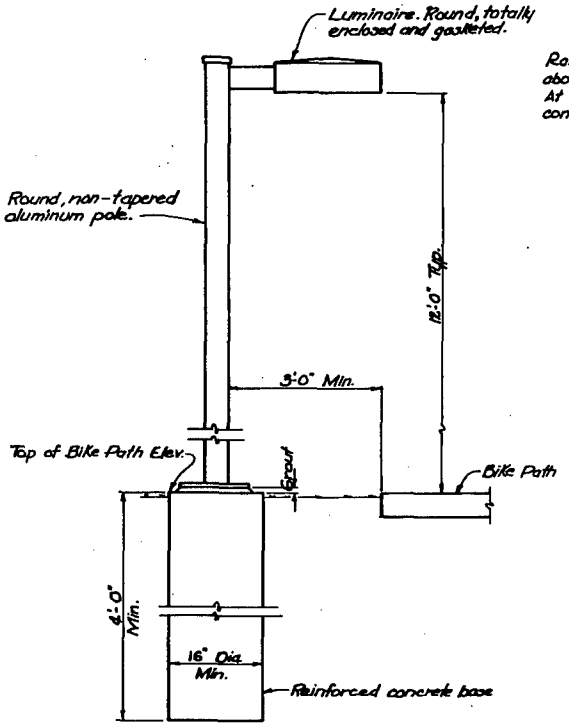
PLATE 49

2



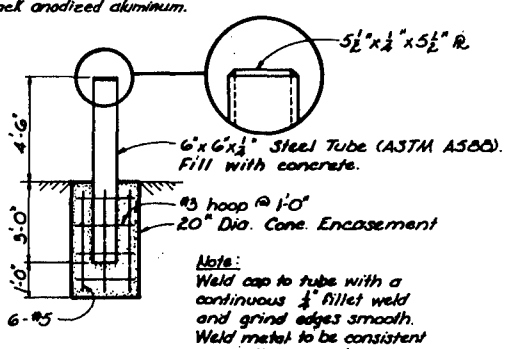
TYPE 'G'

Rail posts are on concrete bases as shown above where bike path is bituminous material. At other locations this rail will attach to concrete slab.



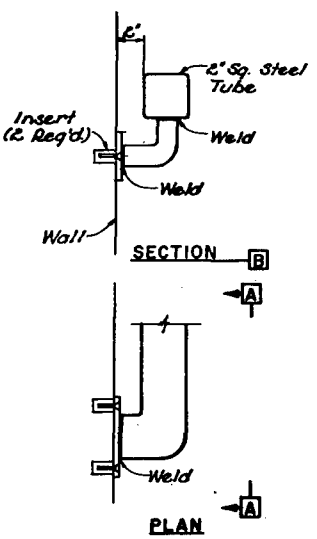
LIGHTING STANDARD
NO SCALE

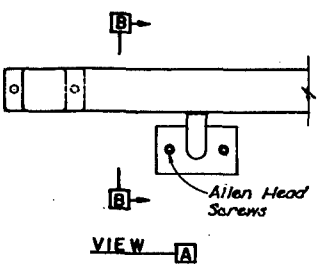
Light pole, mast arm and luminaire to be black anodized aluminum.



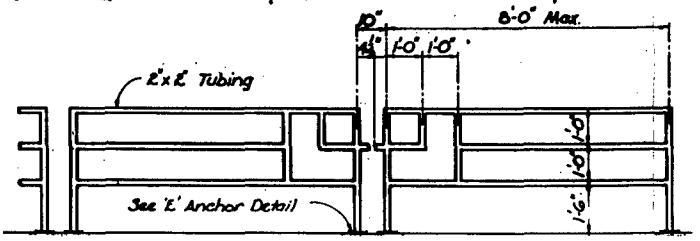
Note:
Weld cap to tube with a continuous ¼" fillet weld and grind edges smooth. Weld metal to be consistent in weathering to base metal.

GUARD POST BARRIER
TYPE 'C'
NO SCALE

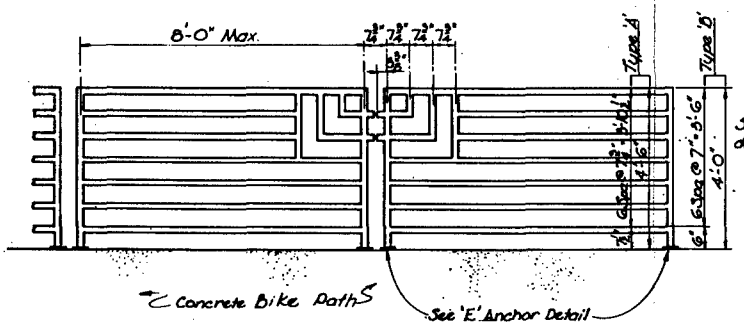




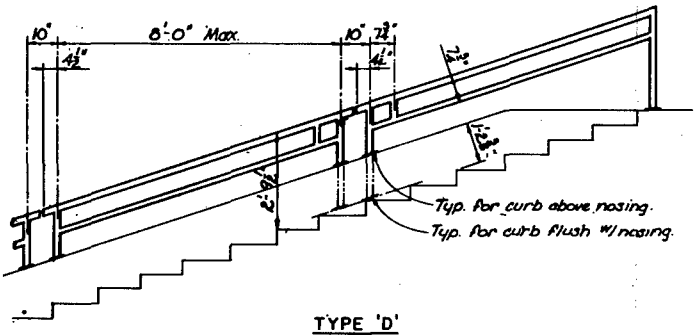
TYPE 'F'
STEEL HANDRAIL DETAILS
NO SCALE



TYPE 'E'



TYPE 'A' & 'B'

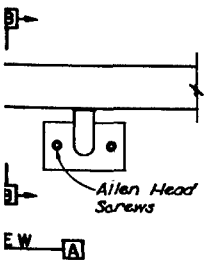


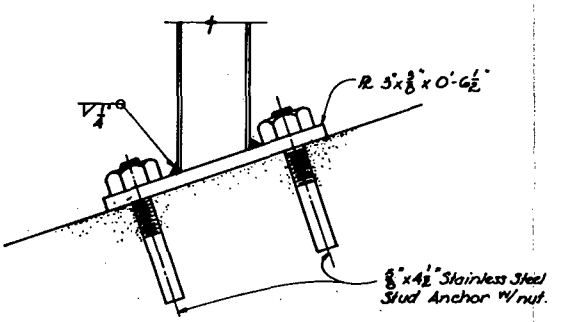
TYPE 'D'

STEEL HANDRAIL DETAILS

2 0 2 4

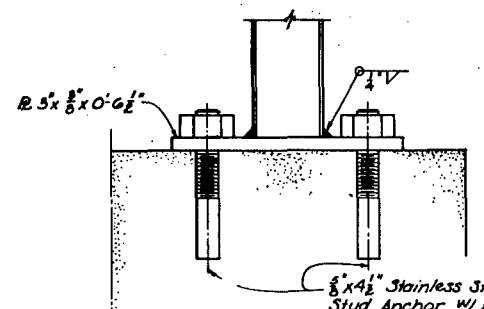
1/2" = 1'-0"



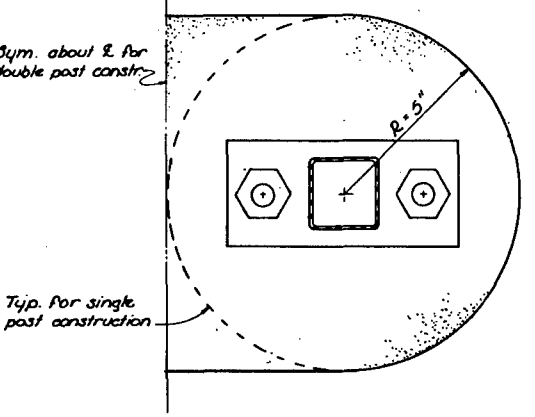


TYPE 'D' ANCHORAGE DETAIL

ONE HALF FULL SCALE



ELEVATION



PLAN

TYPE 'E' ANCHORAGE DETAIL

ONE HALF FULL SCALE

General Notes:

1. Handrail on Floodwalls and Wingwalls.
   - Type B Sta. 169+40 to 174+79 Rt. Bank
     Sta. 176+25 to 186+20 Lt. Bank
     Sta. 186+20 to 202+90 Lt. Bank
     Sta. 202+90 to 204+97 Lt. Bank
   - Type E Sta. 165+15 to 169+05 Rt. Bank
     Sta. 177+50 to 184+76 Rt. Bank
     Sta. 185+93 to 186+53 Rt. Bank
     Sta. 187+45 to 193+45 Rt. Bank
     Sta. 172+40 to 173+45 Lt. Bank
     Sta. 173+75 to 175+80 Lt. Bank
     Seventh St. N.E. bridge

2. Handrail on Bike Path.
   - Type A Seventh St. Underpass
     East Center St. Underpass (to Sta. 189+00)
     3rd Ave. Underpass
   - Type B Sta. 159+00 to 159+30 Rt. Bank (both sides of walk)
     Sta. 160+25 to 160+80 Rt. Bank (both sides of walk)
     Sta. 164+95 to 169+35 Rt. Bank
     Sta. 176+38 to 183+67 Rt. Bank
     Sta. 189+00 to 193+77 Rt. Bank
     Sta. 4+75 to 6+10 Lt. Bank

3. Handrail at River Accesses:
   - Type E Sta. 160+30, Sta. 176+00, Sta. 195+20, Sta. 196+00
   - Type D Sta. 160+30, Sta. 195+20
   - Type F Sta. 176+00, Sta. 196+00

4. Guard Post Barrier
   - Type C Sta. 176+60 Lt., Sta. 180+20 Lt., Sta. 187+35 Rt.

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS - Consulting Engineers & Planners, Mason City, Ia. - Dubuque, Ia. - Rochester, Mn.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

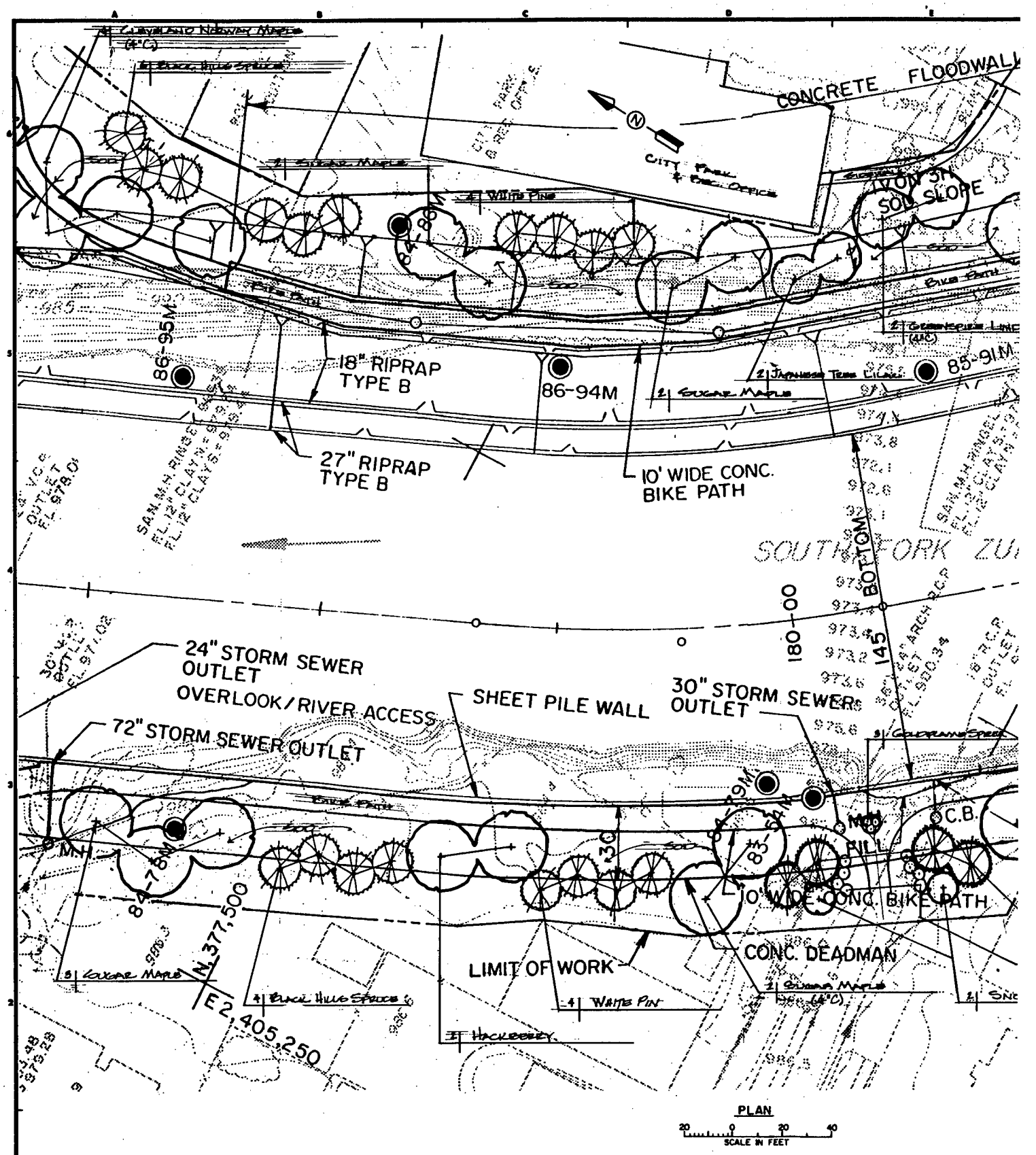
DESIGN MEMORANDUM NO. 2 — FEATURE

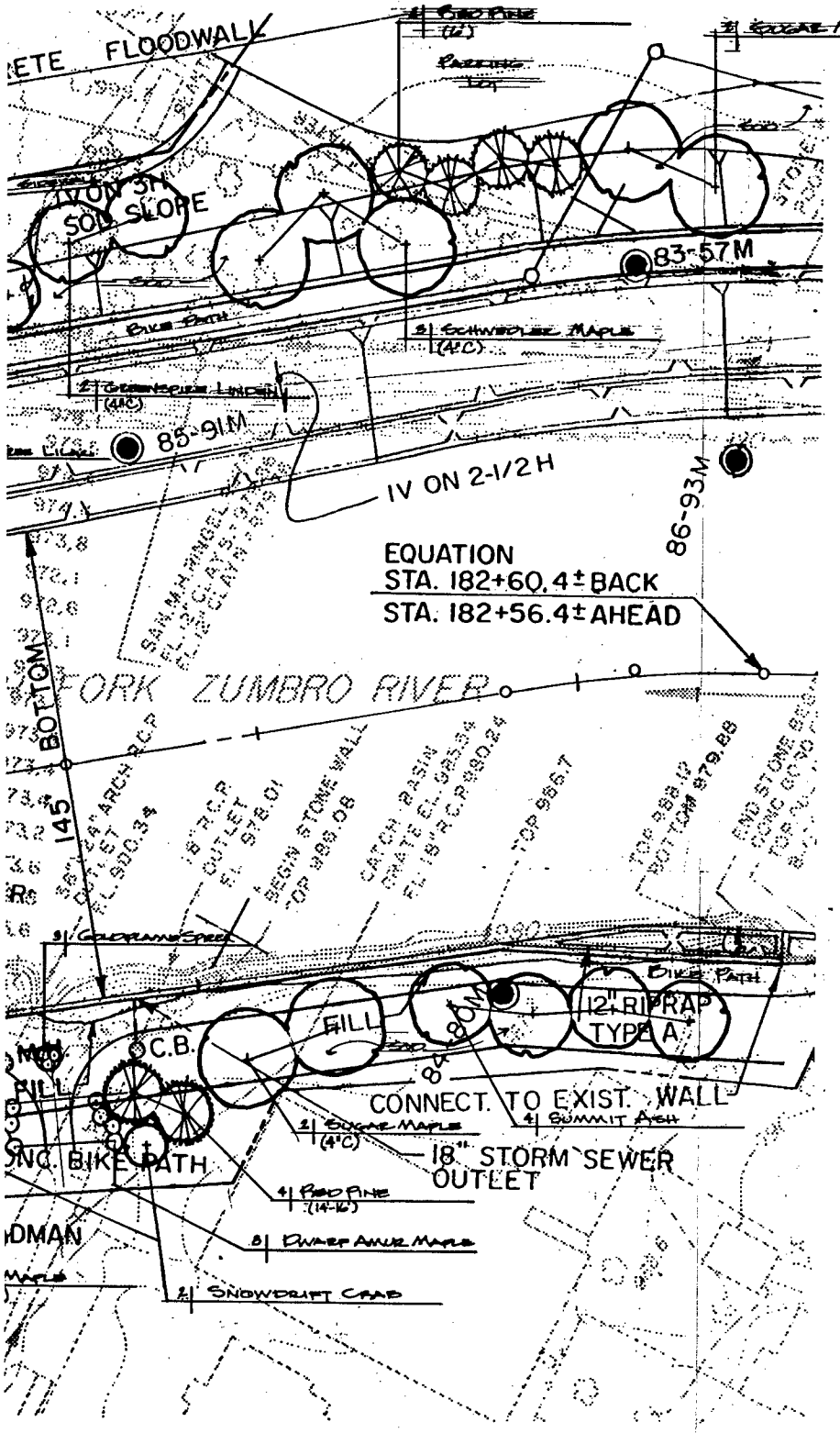
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA

STAGE - 1B
LIGHTING STANDARD
STEEL HANDRAIL
GUARD POST BARRIER

DESIGNED BY:	G.E.G.
DRAWN BY:	L.M.G.
TRACED BY:	C.E.W.
SUBMITTED BY:	
APPROVED BY:	
DATE:	MARCH 1988
SCALE:	AS SHOWN
CONTRACT NO.	DACW37-88-B-0036
DRAWING NUMBER	M30-R-61/14
SHEET NO.	50 OF 51

PLATE 50


CONCRETE FLOODWALL
CITY PARK & REC. OFFICE
CITY PARK & REC. OFFICE
IVON ST.
SOD SLOPE
BIKE PATH
86-95M
18" RIPRAP TYPE B
86-94M
85-91M
27" RIPRAP TYPE B
10' WIDE CONC. BIKE PATH
SOUTH FORK ZU
BOTTOM
180-00
145
24" STORM SEWER OUTLET
OVERLOOK/RIVER ACCESS
72" STORM SEWER OUTLET
SHEET PILE WALL
30" STORM SEWER OUTLET
MH
87-78M
N 377,500
E 2,405,250
LIMIT OF WORK
CONC. DEADMAN
10' WIDE CONC. BIKE PATH
C.B.
PLAN
SCALE IN FEET



PLANT SCHEDULE

QUANTITY	COMMON NAME	BOTANICAL NAME	CONDITION	SIZE
4	CLEVELAND NORWAY MAPLE	ACER PLATANOIDES 'CLEVELAND'	BB	4"C
2	GREENSPIRE LINDEN	TILIA CORDATA 'GREENSPIRE'	BB	4"C
2	HACKBERRY	CELTIS OCCIDENTALIS	BB	2½"C
8	SCHWEDLER MAPLE	ACER PLATANOIDES 'SCHWEDLERI'	BB	4"C
7	SUGAR MAPLE	ACER SACCHARUM	BB	2½"C
4	SUGAR MAPLE	ACER SACCHARUM	BB	4"C
4	SUMMIT ASH	FRAXINUS PENNSYLVANICA LANCEOLATA 'SUMMIT'	BB	2½"C
10	BLACK HILLS SPRUCE	PICEA GLAUCA DENSATA	BB	6'
4	RED PINE	PINUS RESINOSA	BB	6'
4	RED PINE	PINUS RESINOSA	SPADE	14-16'
8	WHITE PINE	PINUS STROBUS	BB	6'
2	JAPANESE TREE LILAC	SYRINGA AMURENSIS JAPONICA	BB	2½"C
2	SNOWDRIFT CRAB	MALUS 'SNOWDRIFT'	BB	2"C
8	DWARF ARUL MAPLE	ACER GINNALA COMPACTA	POT	3'
3	GOLDFLAME SPIREA	SPIRAEA BUMALDA 'GOLDFLAME'	POT	18"

NOTES:

1. ALL RED PINE 14'-16' (SPADE) SHALL HAVE ALL BRANCHES REMOVED FROM GROUND LEVEL TO 6 FEET ABOVE GROUND LEVEL.
2. ABBREVIATIONS:
   BB - BALLED AND BURLAPPED
   POT - CONTAINER GROWN
   2½"C, 2½"C, 4"C - CALIPER SIZING
   2', 3', 6' - HEIGHT SIZING
   SPADE - SPADE MOVED

SYMBOL	DESCRIPTION	DATE	APPROVAL

WHKS – Professional Engineers & Planners
Mason City, Ia. - Rochester, Minn. - Dubuque, Ia.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: D.W.
DRAWN BY: D.W.
CHECKED BY: D.O
SUBMITTED BY:

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE IB
LANDSCAPE DEVELOPMENT PLAN
177+00 TO 182+00 (TYPICAL)

APPROVED BY:
DATE: APRIL 1988
SCALE: AS SHOWN
DRAWING NUMBER: M30-R-61/15
SHEET 51 OF 51

SAFETY DAYS

PLATE 51

DRAFT
ENVIRONMENTAL ASSESSMENT
DESIGN CHANGES TO REACH 1B OF THE ROCHESTER FLOOD CONTROL PROJECT ON THE SOUTH FORK ZUMRO RIVER AT ROCHESTER, MINNESOTA

U.S. Army Corps of Engineers
St. Paul District

DRAFT
ENVIRONMENTAL ASSESSMENT
DESIGN CHANGES TO REACH 1B OF THE
ROCHESTER FLOOD CONTROL PROJECT
ON THE SOUTH FORK ZUMBRO RIVER AT
ROCHESTER, MINNESOTA

1.00 SUMMARY

1.01 The Water Resources Development Act of 1974 (Public Law 93-251) authorized the proposed flood control project at Rochester, Minnesota. The plan consists primarily of a combination of channel work, bridge modifications, and modifications to the Silver Lake Dam. Fish and wildlife mitigation features include acquisition and management of approximately 140 acres adjacent to the Keller Wildlife Management Area, construction of a meandering low-flow channel in selected reaches, and the placement of large riprap to provide instream habitat. The plan is described in the Phase II Design Memorandum for the project dated September 1982. A Final EIS for the project was filed in 1979. A Supplemental Information Report to the EIS and a 404(b)(1) evaluation was completed in 1982.

1.02 Implementation of the flood control project at Rochester is divided into five stages of construction. Advanced engineering and design studies for Reach 1B, which extends from Silver Lake Dam to the Third Avenue S.E. bridge on the South Fork Zumbro River, have identified several areas of environmental impacts that were not addressed in either the Final EIS or the Supplemental Information Report. This assessment was prepared to address these newly identified environmental effects.

1.03 An environmental review of the newly identified impacts indicates that they would not be significant. Therefore, a supplement to the Final EIS will not be prepared.

Relationship to Environmental Requirements

1.04 The proposed activities would be in compliance with all applicable Federal environmental laws, Executive Orders and policies, and State and local laws, including the Clean Air Act, as amended; the Clean Water Act of 1977; the Endangered Species Act of 1973, as amended; the Land and Water Conservation Fund Act of 1965, as amended; the National Historic Preservation Act of 1966, as amended; the National Environmental Policy Act of 1969, as amended; the Fish and Wildlife Coordination Act of 1958, as amended; Executive Order 11988-Floodplain Management; and Executive Order 11990-Protection of Wetlands. Reach 1B is located in an urban area and would not result in the conversion of farmland to nonagricultural uses. Therefore, the provisions of the Farmland Protection Policy Act of 1981 do not apply.

2.00 NEED FOR AND OBJECTIVES OF ACTION

2.01 The Water Resources Development Act of 1974 (Public Law 93-251) authorized the proposed flood control project at Rochester, Minnesota. A Final EIS for the project was filed in 1979. That document identified the need for fish and wildlife mitigation for unavoidable losses due to construction. Mitigation features include the acquisition and management of approximately 140 acres adjacent to the State Keller Wildlife Management Area, the

construction of a meandering low-flow channel in selected reaches, and the placement of large riprap to provide instream habitat. Design changes developed during the Phase II Design Studies were generally to channel configurations and the elimination of unnecessary features. A Supplemental Information Report to the Final EIS and a 404(b)(1) evaluation, dated September 1982, were prepared to address these changes. No additions or deletions to the approved fish and wildlife mitigation plan were recommended at that time.

2.02 Implementation of the flood control project at Rochester is divided into five stages of construction. Work scheduled for reach 1B, which extends from Silver Lake Dam to the Third Avenue S.E. bridge on the South Fork Zumbro River (plate 1), consists of channel modifications to the South Fork Zumbro River and a portion of Bear Creek, and modifications to Silver Lake Dam. Advanced engineering and design studies identified the need to dewater Silver Lake in order to excavate the channel bedrock upstream of the reservoir. The need to draw down Silver Lake was not identified in previous planning or design studies because the extent of bedrock was not known at that time. In addition, chemical analysis of soil borings taken on the left bank just upstream of the Dakota, Minnesota and Eastern Railroad bridge indicates the presence of contaminated soils. Special handling procedures will be required during excavation of soils at this site.

Local Concerns

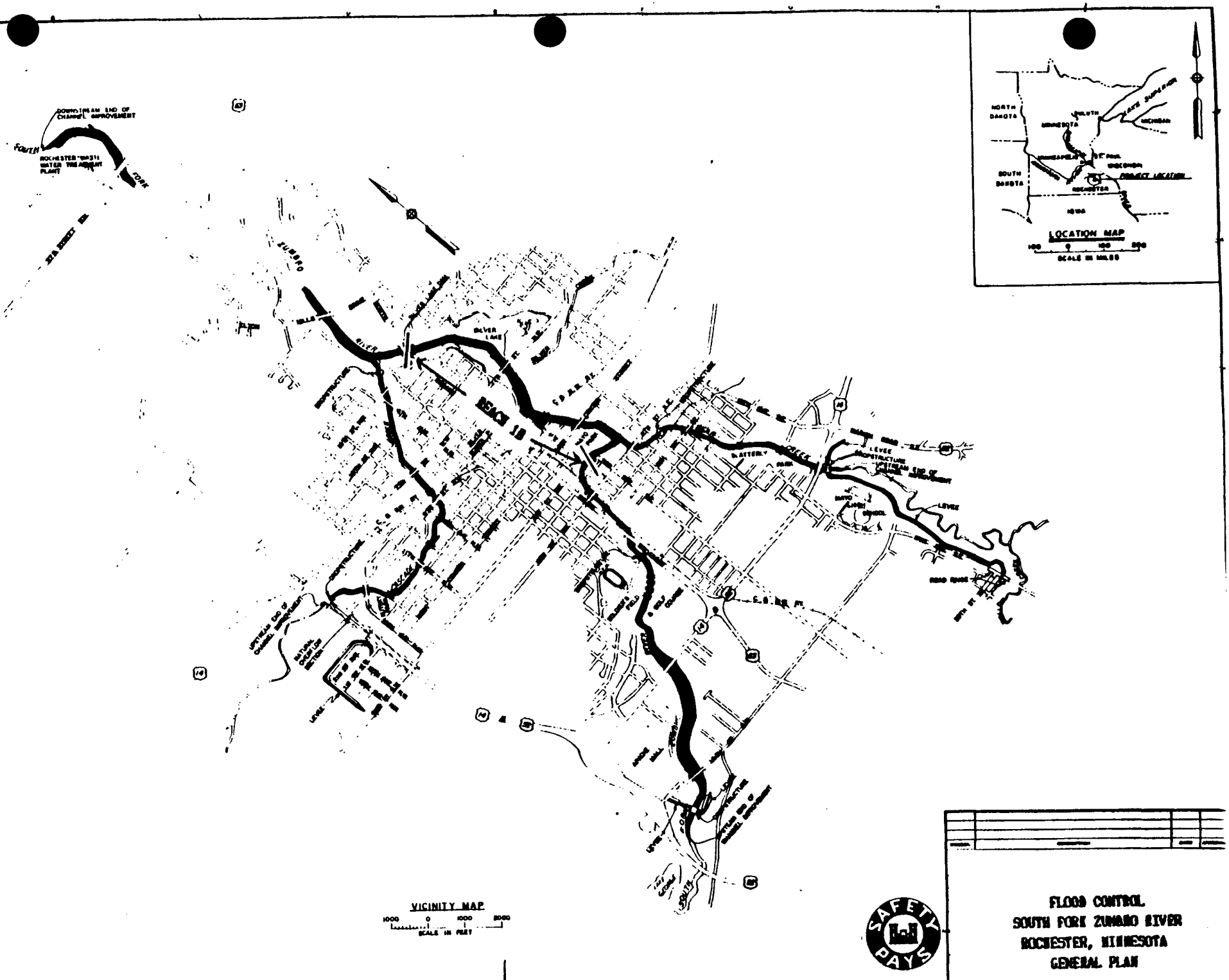
2.03 The City of Rochester has recently raised concerns about the aesthetic impacts of lower water levels in the modified channel adjacent to Mayo Park. In response to these concerns, alternative methods to riprap for shoreline protection and attendant landscaping were investigated to minimize aesthetic impacts in this reach. The detailed discussion of those investigations is presented in the Supplement to the Design Memorandum No. 2 for Stage 1B.

3.00 ALTERNATIVES

3.01 Alternatives to the proposed project were evaluated in the Final EIS. The proposed changes in the methods of construction, and the identification of possible impacts, are a result of detailed engineering studies. The current design is required to ensure the project achieves its purpose of providing protection in this reach. Therefore, only alternative methods of dewatering the channel during construction were considered.

Plans Eliminated from Further Study

3.02 Channel modifications in reach 1B, upstream of the reservoir, require the dewatering of the channel to excavate up to 5 feet of channel bedrock. Two alternatives to the complete drawdown of Silver Lake to facilitate this procedure were investigated: (1) a partial drawdown of the reservoir and (2) the construction of a cofferdam at the inlet to the reservoir. Neither of these alternatives was found to be feasible. A partial drawdown of the reservoir would not drop the water surface elevation sufficiently to allow adequate dewatering of the channel. The construction of a cofferdam at the inlet of the reservoir was dropped for engineering and economic reasons.



EA-3

FLOOD CONTROL
SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
GENERAL PLAN

PLATE 1

Selected Plan

3.03 Work scheduled for Reach 1B includes dam modifications, scour protection at six bridges, approximately 8,500 feet of channel modifications on the South Fork Zumbro River and a portion of Bear Creek, replacement of an existing storm sewer, construction of headwalls for existing storm sewer outlets, construction of a floodwall along a portion of the left bank, and construction of about 1 mile of bicycle trail. Detailed information on these features is presented in the Design Memorandum No. 2 for Stage 1B, dated February 1987.

3.04 Excavation of the channel upstream of the reservoir will require a total drawdown of Silver Lake. Drawdown of the reservoir will commence as soon as practicable in the spring of the year of construction. To minimize disturbance to overwintering geese, dewatering activities at Silver Lake will be halted by late October and the lake will be allowed to refill by 1 November. Dam modifications will continue during the winter.

3.05 The drawdown of the lake will be done in a manner that does not increase turbidity or otherwise deteriorate water quality downstream. One such approach may be to dewater the reservoir from the top down. Other approaches to preventing downstream impacts during drawdown will be investigated during the development of plans and specifications. A minimum flow will be released during the refilling of the dam in order to maintain the fisheries downstream of the dam.

3.06 Silver Lake will be restocked with fish by the Corps of Engineers after project construction in this reach. This action would allow the Minnesota Department of Natural Resources (DNR) to maintain the continuity of a recently implemented fisheries management program for the lake. The amounts and types of fish to be restocked will be coordinated with the Minnesota DNR. Current estimates for completing this feature are $11,000.

3.07 The following construction procedures will be followed for the excavation of contaminated soils between stations 174.3 and 176. The top 3 feet of soil on the site would be stripped and, if suitable, used for backfill. Between stations 174.3 and 175, all soils excavated below 3 feet would be handled and disposed of as hazardous waste, and clean fill would be used as backfill. No special handling procedures would be required between stations 175.3 and 176, as the data indicates that no contaminated soils are present in the vertical zone required for construction (a depth of 10 feet). Depending on construction procedures used, the amount of soils excavated that would be treated as hazardous waste ranges from 350 to 750 cubic yards. Excavation and disposal procedures would be developed through continued coordination with the Minnesota Pollution Control Agency (PCA). Costs associated with the special handling and disposal of contaminated soils would be the responsibility of the local sponsor.

3.08 Alternative methods of construction of flood protection features between stations 174.3 and 176 will be considered during plans and specifications in an effort to minimize the excavation of contaminated soils. Since the local sponsor is responsible for the costs associated with the handling and disposal of contaminated soils, alternative methods of handling and disposal of contaminated soils may be developed by the local sponsor through coordination with the Minnesota Pollution Control Agency.

3.09 To address local concerns over the aesthetic acceptability of the previously proposed riprap slopes in Mayo Memorial Park, sheetpile and concrete floodwalls with a riprap lower slope are proposed in the Mayo Memorial Park area. A recreation path will be constructed on the right bank above the riprap slope and below the concrete floodwall. A path along the left bank will be positioned at the top of a concrete capped sheetpile wall. A more detailed decription of aesthetic/recreation features can be found in the Supplement to the Design Memorandum No. 2 for Stage 1B.

4.00 AFFECTED ENVIRONMENT

Natural Resources

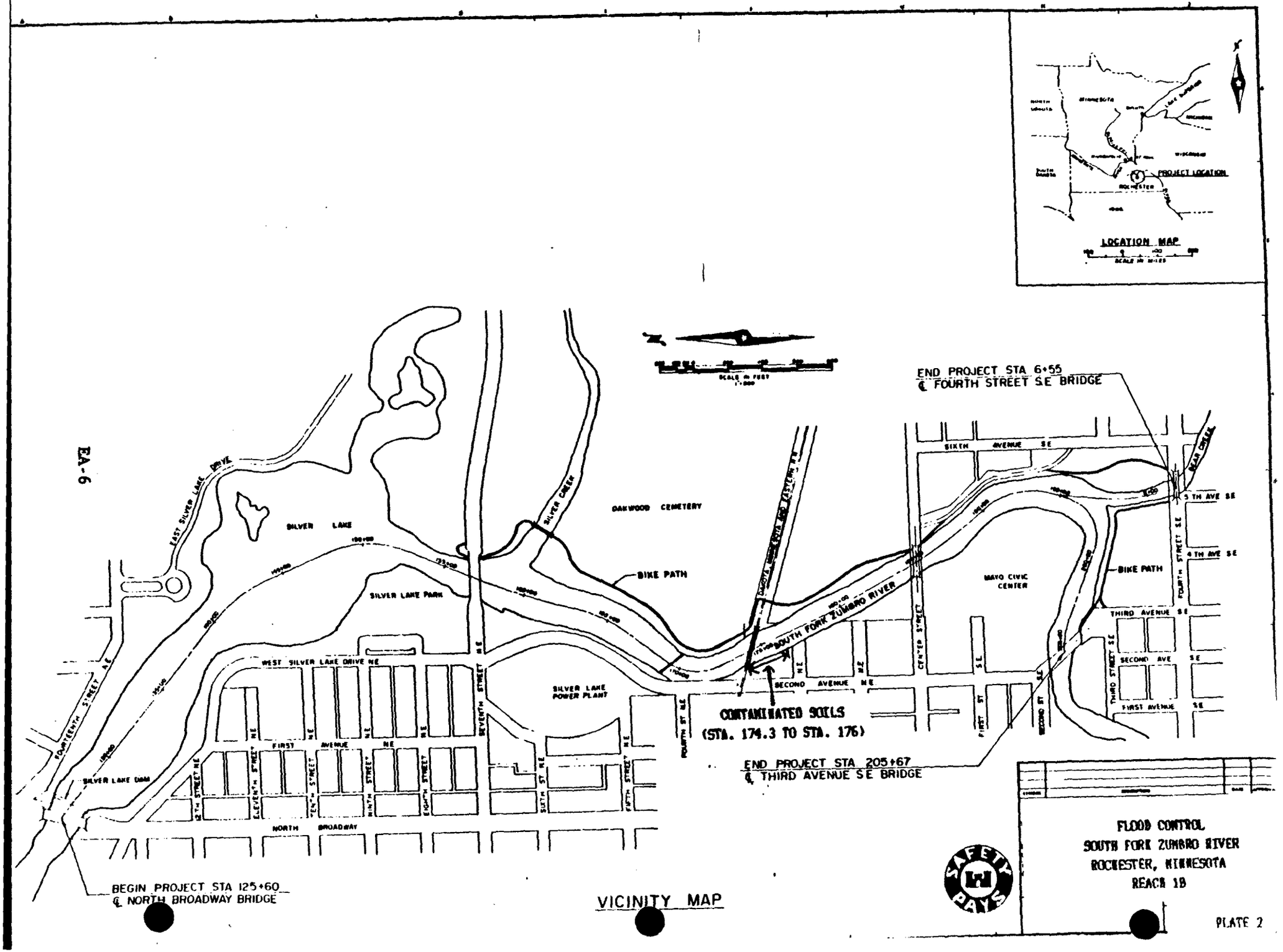
4.01 Land use in this reach of the South Fork Zumbro River is a mix of residential, light industrial, and commercial development. Some riverfront park areas are present. Woodlands are characteristic of an urban environment; they are highly disturbed with little understory and are limited to one to two trees in width along the river. The park areas are thinly to moderately wooded with well-maintained lawns. Tree species present include American elm, box elder, sugar maple, basswood, green ash, cottonwood, and black willow.

4.02 Silver Lake is a moderately used urban fishery. Review of past and present management practices of the lake indicates it is a fishery of moderate value. Management efforts by the Minnesota Department of Natural Resources from 1964 to 1974 consisted primarily of a put-and-take bullhead fishery. A more intensive effort to establish a catfish population in Silver Lake was initiated by the Minnesota DNR in 1981, and it appears to be having moderate success. Survey results from 1983 to 1985 indicate that, in addition to catfish, the lake also supports limited populations of largemouth bass, crappie, sunfishes, bullhead, suckers, and shiners. High turbidity, limited depth, abundant silt substrates, and lack of submerged vegetation limit game fish abundance in the lake.

4.03 Silver Lake is an important wintering area for thousands of Canada geese because of the year-round open water provided by the thermal discharge from the Silver Lake Power Plant. In mid-winter, the goose population averages 15,000, with peak populations of up to 30,000. Most of the geese migrate north around the end of March or the beginning of April. A resident population of about 200 geese remains and nests locally.

4.04 As noted in the Final EIS for the project, no threatened or endangered species are present in the project area. However, the peregrine falcon and the bald eagle may occasionally be sighted during migration.

4.05 Chemical analysis of soil borings taken on the left bank just upstream of the Dakota, Minnesota and Eastern Railroad bridge at station 174.5 (plate 2) indicates that soils in that reach are contaminated. The site was once the location of a coal gasification plant (Rochester Gas Manufacturing) which operated from 1888 to 1940. Contaminants found in the soil, polynuclear aromatic hydrocarbons (PAHs) and heavy metals, are indicative of the types of waste that were produced at these facilities. The Rochester Gas Manufacturing (RGM) site was recently submitted by the Minnesota Pollution Control Agency to the U.S. Environmental Protection Agency (EPA) for investigation and consideration for cleanup under EPA's superfund program. The results of EPA's investigation are not yet available.



VICINITY MAP

4.06 The Corps of Engineers took a series of borings in March 1988 to determine the areal extent of contaminated soils within the construction zone of the project. Contaminated soils were determined by visual and olfactory characteristics. Investigations indicate that contaminated soils extend to a depth of 30 feet and are confined to a 170-foot reach of the construction zone. Soils appeared more contaminated at the northern limits of the construction zone (station 174.5) and were not contaminated at the southern limits of the construction zone (station 176). Heavily contaminated soils were evident along the landward limits of the construction zone (approximately 50 feet from the riverbank) and suggest that contamination outside of the construction zone is also extensive.

Cultural Resources

4.07 In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, the National Register of Historic Places was consulted. As of April 19, 1988, there are no properties listed on or determined eligible for inclusion on the National Register that will be affected by the proposed project in reach 1B. In addition, no sites were identified during cultural resource surveys of reach 1B. Therefore, no further archeological work is required for this reach.

Recreation/Aesthetics

4.08 The Zumbro River has two city parks adjacent to its banks in reach 1B, Silver Lake Park and Mayo Memorial Park. The 125-acre Silver Lake Park at 7th Street and 2nd Avenue NE has a swimming pool, trails, picnic facilities, restrooms, ballfields, play equipment, and hockey rinks. Silver Lake Park is adjacent to Silver Lake and Silver Creek. Mayo Memorial Park is located at East Center Street and 2nd Avenue SE. This 27-acre park includes the Mayo Civic Auditorium, Civic Theater, Mayo Memorial, and picnic and play facilities.

4.09. Much of the existing riverbank through reach 1B is vegetated and has a naturalized appearance. Other existing shoreline conditions are found intermittently through the reach and include concrete fabriform, sheetpile walls, riprap, stone walls, and concrete walls. Although the shoreline elements vary, existing top of bank vegetation provides an element of visual continuity.

5.00 ENVIRONMENTAL EFFECTS

5.01 An environmental analysis has been conducted for the newly identified impacts associated with construction of the project at Rochester, and a discussion of those impacts is presented in the following paragraphs. The discussion addresses only the effects that have recently been identified during advanced engineering and design studies for reach 1B. As specified in Section 122 of the 1970 Rivers and Harbors Act, the categories of impacts listed in table EA-1 were reviewed and considered in arriving at the final determination.

Natural Resources

5.02 Advanced engineering and design studies have identified that construction activities in reach 1B would result in additional impacts to natural resources

TABLE EA-1 - Evaluation of Impacts of Design Changes

Environmental Impact Assessment Matrix	Magnitude of Probable Impact						
	Increasing Beneficial Impact			No Appreciable Effect	Increasing Adverse Impact		
Name of Parameter	Significant	Substantial	Minor		Minor	Substantial	Significant
A. Social Effects							
1. Noise Levels				X			
2. Aesthetic Values				X			
3. Recreational Opportunities			X				
4. Transportation				X			
5. Public Health and Safety				X			
6. Community Cohesion (Sense of Unity)				X			
7. Community Growth and Development				X			
8. Business and Home Relocations				X			
9. Existing/Potential Land Use				X			
10. Controversy				X			
B. Economic Effects							
1. Property Values				X			
2. Tax Revenues				X			
3. Public Facilities and Services				X			
4. Regional Growth				X			
5. Employment				X			
6. Business Activity				X			
7. Farmland/Food Supply				X			
8. Commercial Navigation				X			
9. Flooding Effects				X			
10. Energy Needs and Resources				X			
C. Natural Resource Effects							
1. Air Quality				X			
2. Terrestrial Habitat				X			
3. Wetlands				X			
4. Aquatic Habitat					X		
5. Habitat Diversity and Interspersion				X			
6. Biological Productivity					X		
7. Surface Water Quality					X		
8. Water Supply				X			
9. Groundwater				X			
10. Soils				X			
11. Threatened and Endangered Species				X			
D. Cultural Effects							
1. Historic Architectural Values				X			
2. Prehistoric and Historic Archeological Values				X			

in the area. However, the scope and magnitude of the impacts would not be substantially different from what was described in the Final EIS.

5.03 The overwintering concentration of Canada geese on Silver Lake is regionally significant. The importance of Silver Lake increases as open water areas near Rochester begin to freeze. By mid-November, Silver Lake is the only body of open water in the area. Allowing the lake to refill by 1 November will ensure that Silver Lake is available to the goose population in the region prior to and during freeze-up of the surrounding area.

5.04 Dam modification activities would continue during the winter. The goose population at Rochester is fairly tolerant of human disturbance, and construction activities at the damsite would not appreciably affect the use of the lake by the geese.

5.05 The drawdown of Silver Lake would have minor effects downstream of the reservoir. The lake would be drawn down in a manner that does not significantly deteriorate water quality downstream. A minimum flow would be released during the refilling of the lake in order to maintain the fisheries downstream of the dam.

5.06 The drawdown of Silver Lake would result in moderately adverse impacts to the existing fisheries resource of the lake. Silver Lake was subjected to a near total drawdown during repairs to the dam in 1981. Minnesota DNR records show that no efforts, other than a program to establish a catfish population, have been pursued. However, survey results from 1983 to 1985 indicate the lake supports limited populations of a fairly wide variety of game fish. It is reasonable to assume that similar populations would reestablish in the lake after construction. Therefore, the impacts to the fishery in Silver Lake are considered temporary.

5.07. Based on the above information, the impacts to the fisheries in Silver Lake, due to lake drawdown, would not be of such significance as to require mitigation. However, drawdown of the lake would interrupt a recently implemented Minnesota DNR management program for the lake. To allow continuity of the fisheries management program for the lake, initial restocking of the reservoir will be done by the Corps of Engineers after project construction in this reach.

5.08 As noted earlier, soils within a 170-foot reach of the project area, between stations 174.3 and 176, are contaminated with PAHs and heavy metals, most likely the result of the operations of a coal gasification plant that once operated at the site. The Minnesota Pollution Control Agency has indicated that a cleanup plan for the entire Rochester Gas Manufacturing site will need to be developed. Before such a plan can be developed, investigations to determine the extent of contamination outside the construction zone are required. Any such investigations, as well as the development and implementation of a cleanup program, would be the responsibility of State and local authorities. Considering the probable extent of contamination, and the potential number of parties involved in arriving at a final course of action, it is unlikely that an overall program for resolving the problems at the RGM site will be developed before the scheduled construction season for reach 1B.

5.09 The excavation of up to 750 cubic yards of contaminated soils between stations 174.3 and 176 would not appreciably alter conditions at the RGM site.

The amount of soils that would be excavated is minor when compared to the probable volume of contaminated soils at the site. The construction of project features in this reach would not preclude the implementation of any cleanup program that may be developed for the RGM site in the future.

Cultural Resources

5.10 Construction of reach 1B will have no effect on any sites listed on or determined eligible for inclusion on the National Register. In addition, there are no known sites in the project area. Therefore, no sites will be affected.

Aesthetic/Recreation Resources

5.11 Recreational opportunities will be enhanced with the construction of a multi-purpose asphalt and river access landing. Additional facilities to be provided include a trail shelter, a pedestrian/bicycle bridge over Silver Creek, and a small visitor parking lot. Existing recreation facilities (shelters, swimming pool, play equipment, etc.) at Silver Lake Park and Mayo Memorial Park would not be directly affected by the flood control project construction.

5.12 Further review of shoreline protection alternatives was done in response to city of Rochester concerns relating to project aesthetics. Use of sheetpile and concrete floodwalls with a riprap lower slope has satisfied concerns over the aesthetic acceptability of the previously proposed riprap slopes in Mayo Memorial Park. Recreation paths have been incorporated into the bank protection cross section on the left and right banks of the Zumbro River at Mayo Memorial Park. The right bank path is located at an intermediate level above the riprap slope and below a concrete floodwall. The left bank path is positioned at the top of a concrete capped sheetpile wall.

5.13 Incorporating the paths into the bank protection maintains a level of river awareness for the user that would have been adversely affected by riprap protection alone. Tying the paths to the bank protection also helps bond the walls to the park as a compatible architectural element rather than an engineered intrusion. Additional visual compatibility is provided by the top-of-wall guardrail design that will be used throughout the project for visual continuity.

6.00 COORDINATION

6.01 Coordination with public and government agencies has been maintained during the planning process. The State Historic Preservation Officer identified no special concerns associated with the proposed actions. Coordination letters from the U.S. Fish and Wildlife Service and the Minnesota Department of Natural Resources are included in exhibit 1. The Fish and Wildlife Service and the Minnesota DNR expressed concerns over possible impacts of the drawdown of Silver Lake on the goose population at Rochester. Their suggestion to discontinue dewatering the lake in October and allow the lake to refill by November 1 was incorporated into the Corps construction plan.

6.02 The Minnesota DNR requested mitigation for the fishery impacts associated with lake drawdown. As discussed in Section 5.00, the Corps of Engineers does

not feel mitigation for the Silver Lake fisheries is warranted. However, in light of the recent DNR program to establish a catfish population in the lake, the Corps will do an initial restocking of the lake after construction. This action would allow the Minnesota DNR to maintain some continuity in their recently implemented program.

6.03 The Minnesota DNR and the Fish and Wildlife Service recommended that drawdown procedures be done in such a manner as to minimize impacts downstream of the dam and to maintain a minimum flow during refilling of the dam. These recommendations will be included in the Corps construction plan.

6.04 The Corps of Engineers has maintained coordination with the Minnesota Pollution Control Agency concerning the contaminated soils between stations 174.2 and 176. The Minnesota PCA concurs with the Corps approach to handling of the soils in this area.

6.05 Design modifications addressing aesthetics have been coordinated with the city of Rochester and the city's design consultant. The design changes incorporated into the project address the concerns over the project's visual effects and have been endorsed by the appropriate city officials and committees.

6.06 The draft environmental assessment will be sent to interested citizens and the following agencies:

Federal

Department of Transportation
Environmental Protection Agency
U.S. Coast Guard
U.S. Fish and Wildlife Service
U.S. Geological Survey
National Park Service
Soil Conservation Service
Advisory Council on Historic Preservation

State of Minnesota

Department of Energy, Planning and Development
Department of Agriculture
Department of Health
Department of Natural Resources
Department of Transportation
Pollution Control Agency
State Archaeologist
State Historic Preservation Officer
Water Resources Board

Others

Mayor of Rochester
Rochester City Council
Rochester Park and Recreation Department
City Engineer, Rochester
Izaak Walton League of America, Minnesota Division

Minnesota Waterfowl Association
Chairman, Citizens Advisory Committee, Rochester

EXHIBIT 1

Correspondence

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ST. PAUL FIELD OFFICE, (ES)
50 Park Square Court
400 Sibley Street
St. Paul, Minnesota 55101

IN REPLY REFER TO:

October 1, 1987

Colonel Joseph Briggs
District Engineer, St. Paul District
U.S. Army Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101-1479

Dear Colonel Briggs:

This letter constitutes our draft Fish and Wildlife Coordination Act Report for Stage 1B of the South Fork Zumbro River flood control project at Rochester in Olmsted County, Minnesota.

The Fish and Wildlife Service (Service) has been involved in the overall Rochester project for many years. The original project consisted of a combination of channel work, bridge modifications, and modifications to the Silver Lake Dam. A habitat evaluation of the overall project was conducted by a tri-agency team of biologists representing the Minnesota Department of Natural Resources, St. Paul District Corps of Engineers, and the Service using the Habitat Evaluation Procedures. Fish and wildlife mitigation features agreed to by the participating agencies for the project included acquisition and management of approximately 140 acres of land adjacent to the Keller Wildlife Management Area, construction of a meandering low-flow channel in specific reaches of the South Fork of the Zumbro River and the placement of large riprap/boulders to provide instream habitat for fish and aquatic organisms.

Implementation of the Rochester flood control project has been divided into five stages. Stage 1B consists of channel modifications to the South Fork Zumbro River and a portion of Bear Creek, and modifications to the Silver Lake Dam.

Silver Lake Dam Modifications

Advanced engineering and design studies conducted by the District identified the need to dewater Silver Lake in order to excavate up to five feet of channel bedrock upstream of the reservoir. The need to dewater Silver Lake was not identified in previous planning or design studies because the extent of the bedrock problem was not known at that time. Stage 1B therefore has the potential to result in additional impacts to fish and wildlife resources in comparison to the original project.

Fish and Wildlife Impacts

Due to the discharge of heated water by the adjacent electrical generating facility, Silver Lake remains ice-free during winter months and provides important habitat to the overwintering population of Canada geese as nearby lakes and ponds freeze up. The goose population averages 15,000 during mid-winter and may peak to 30,000 during some years. Most of the birds migrate north during late March and early April. Loss of this important habitat due to a complete drawdown of Silver Lake during winter months for project construction could adversely impact Canada geese populations.

In addition to wildlife values, Silver Lake also supports a diverse fishery, including smallmouth bass and channel catfish, and receives extensive angling effort. The lake is managed by the Minnesota Department of Natural Resources for sport fishing. Complete drawdown of the lake for project construction will result in the loss of existing fish populations and recreational opportunities.

In an attempt to avoid and minimize fish and wildlife impacts from a complete drawdown, the District evaluated several alternatives including a partial drawdown of Silver Lake and construction of a cofferdam. However, neither of these alternatives were considered to be feasible.

Recommendations to Avoid/Minimize Adverse Impacts

Biologists from the Minnesota Department of Natural Resources and the Service have attended several interagency meetings this past year concerning Stage 1B of the overall project and its associated impacts to fish and wildlife. The following recommendations are provided to avoid and minimize adverse impacts associated with Stage 1B of the project:

1. To avoid adverse impacts to the overwintering population of Canada geese from the proposed drawdown of Silver Lake, the construction contract for Stage 1B should be conditioned such that water levels of the lake are returned to normal elevations by November 1. This would ensure that Silver Lake is available to the goose population in the Rochester area prior to and during freezeup of surrounding areas.

2. The Service recommends that all construction activities be completed in one construction season in order to avoid additional drawdowns of Silver Lake. If in the unlikely event that construction cannot be completed in one season, we recommend that Silver Lake be refilled by November 1 and

subsequently dewatered the following construction season to complete the work, instead of allowing the lake to remain empty throughout the winter period. We believe that providing habitat for Canada geese overwintering in the Rochester area outweighs any additional impacts to the fishery resource and recreational use associated with a second drawdown the following year.

3. To minimize downstream impacts to aquatic resources of the South Fork Zumbro River from construction of Stage 1B of the project, a reservoir dewatering/filling plan should be developed by the District. The objective of the plan should be to establish flow/operational requirements which will avoid and minimize adverse water quality and sedimentation impacts to downstream aquatic resources.

4. To replace fish populations eliminated from Silver Lake due to the complete dewatering of the reservoir, the District should implement an initial restocking program once all construction activities are completed. As discussed at the September 9 interagency meeting, State biologists will provide the District with information concerning species, sizes, and quantities for use in developing the restocking program.

With the incorporation of the above recommendations, Stage 1B of the Rochester flood control project should not result in additional significant adverse impacts to fish and wildlife resources in comparison to the original project.

We would also like to take this opportunity to provide the following comments on the overall Rochester flood control project and mitigation requirements.

<u>Acquisition and Management of Mitigation Lands Adjacent to Keller Wildlife Management Area</u>

The fish and wildlife mitigation plan for the overall Rochester project includes acquisition and management of 140 acres of lands adjacent to the Keller Wildlife Management Area. While the exact location/property boundaries of these lands was not specified at the time of the original HEP evaluation, it was recommended by the tri-agency team that a similar interagency team approach be used to assist the local sponsor in acquiring these lands. As discussed at the September 9 interagency meeting, local sponsors will soon begin the process of land acquisition and are being provided maps by the District to assist in this effort.

In acquiring mitigation lands, we believe it would be advantageous to reestablish the tri-agency team of biologists. Formation of the team would provide consistency throughout the important implementation phase of the overall project. At this time, the group could provide guidance to the local sponsor and Corps in identifying suitable mitigation lands and assisting in the preparation of habitat management plans for project lands. We offer this suggestion for your consideration.

Instream Habitat Mitigation Structures

While the original mitigation plan of adding instream habitat enhancement structures (large riprap/boulders) to portions of the modified channel has not changed in Stage 1B, recent discussions between participating agencies have focused on the design and location of such structures. This issue is discussed in the March 4, 1987 letter from the Minnesota Department of Natural Resources and the District's August 6, 1987 response.

The Service supports the District's proposal to wait until channel modifications are completed before the design, location, and construction of instream habitat structues is initiated. This will allow the channel conditions (current velocity, depth and substrate) in the project area to stabilize before structures are installed. We recommend that a tri-agency team of fishery biologists evaluate channel conditions following completion of the channel work to determine instream structure designs and locations.

We appreciate the opportunity to offer our comments on Stage 1B of tne Rochester project and look forward to working with District personnel on this and other project features.

Sincerely,

Robert F. Welford
Field Office Supervisor

cc: MN Dept. of Natural Resources, Rochester
MN Dept. of Natural Resources, St. Paul
MN Dept. of Natural Resources, Lake City
U.S. Environmental Protection Agency, Chicago

STATE OF
MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

500 LAFAYETTE ROAD • ST. PAUL, MINNESOTA • 55155-4032

DNR INFORMATION
(612) 296-6157

November 16, 1987

Colonel Joseph Briggs
St. Paul District Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, MN 55101

Dear Colonel Briggs:

The purpose of this letter is to summarize the discussion we had with your staff concerning the fish and wildlife mitigation measures for the Rochester flood control project. This discussion took place at our central office on September 9, 1987.

Silver Lake Drawdown

It was agreed that Silver Lake must be restored to its normal winter level by November 1, even if this requires drawing the lake down the following year to complete unfinished work. We understand that construction documents will clearly state that construction requiring the drawdown be completed or postponed in time to allow the lake level to be restored by November 1.

In your letter of August 6, 1987, you stated that you would recommend initial restocking of the lake as outlined in my letter of March 4, 1987, but would not recommend any maintenance stocking. In this case, we request that the initial restocking also include adult fish in order to achieve a more immediate recovery for the lake fisheries. Attached are our estimated costs for obtaining 1000 adult channel catfish and 500 largemouth bass.

A discharge permit may be required for the drawdown of the lake. We understand that the City of Rochester will acquire the necessary permits. We will require that the drawdown of the lake be done in a manner that does not increase turbidity or otherwise deteriorate water quality downstream of the dam. We will also require a minimum flow to be released during the refilling of the lake in order to maintain the fisheries downstream of the dam. The phase of our permit which authorizes this part of the project will address releases from the dam for both the drawdown and the refilling of the lake.

Channel Modification

Mitigation for the channel modification will consist of two parts; the construction of structures in the channel for fish habitat, and the purchase of 140 acres of land adjacent to the Keller Wildlife Management Area.

We understand that the fish habitat structures will be constructed within the project limits. If any structures are constructed in the unchannelized reach of the river between 37th Street and Elton Hills Drive, the DNR will be responsible for acquiring the necessary easements. A task force including representatives of the Corps, the Fish and Wildlife Service, the DNR and the City of Rochester will be formed to develop the specific plans for this mitigation after the project is complete. We understand that $124,000, adjusted for inflation to the time the mitigation is implemented, will be available for this purpose.

We understand that the City of Rochester will be given as much flexibility as possible in the acquisition of the 140 acres of land as long as the original intent of this part of the mitigation is met. This is important because some of the land originally identified for purchase has been developed and is no longer available, or desirable for acquisition. We understand that the land will be purchased as the flood control project is being constructed.

Thank you again for the opportunity to comment on the proposed mitigation measures. If you have any questions, please contact Joe Gibson, Federal Projects Coordinator, at (612) 296-2773.

Sincerely,

DIVISION OF WATERS

Ron Nargang

Ron Nargang
Director

RN/JG:tjb

cc: Gary Neumann, Assistant City Administrator
Larry Shannon, Director, Fish and Wildlife
Bill Johnson, Regional Fisheries Supervisor
Jim Cooper, Regional Hydrologist

DEPARTMENT : Natural Resources - Fisheries

STATE OF MINNESOTA

Office Memorandum

DATE : 091787

TO : Jim Cooper

FROM : Larry Gates

PHONE : (612)345-4219

SUBJECT : Costs Of Restocking Adult Channel Catfish (CCF) And Largemouth Bass (LMB) In Silver Lake

As per the request made at the 090987 meeting on the South Fork Zumbro River/Rochester channelization project, we have developed the following cost estimates for stocking adult CCF and LMB into Silver Lake. We did a limited amount of checking with commercial vendors for these fish and no acceptable resources could be found. For example, Peterson Trout Farm could only provide 6 to 8 inch CCF for a dollar each. Therefore, we have decided to obtain the CCF through a commercial fisherman and the LMB by electrofishing them ourselves.

I. 1000 CCF (ave. wt. 1.5 lbs.) from Lake Zumbro

A. Commercial seining operation
3-man crew and equipment rental
at $500/haul x 3 hauls — $1500

B. Sorting and transportation by state crew
2 technicians and distribution for
equipment at $200/haul x 3 hauls — $600

Subtotal — $2100

II. 500 LMB (ave. wt. 1.0 lbs.) from Mississippi River

A. Electrofishing and distribution

1. manpower
   a. 1 at $12/hr. x 8 hrs. — $96
   b. 1 at $10/hr. x 10 hrs. — $80

2. equipment
   a. 1 electrofishing boat/day — $85
   b. 1 50 hp outboard/day — $33
   c. 1 4x4 truck, $0.36/mi. x 100 mi./day — $36

$270/day

EXHIBIT 2

DRAFT

Finding of No Significant Impact

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
1135 U.S. POST OFFICE & CUSTOM HOUSE
ST. PAUL, MINNESOTA 55101-1479

REPLY TO
ATTENTION OF

Environmental Resources Branch
Planning Division

DRAFT
FINDING OF NO SIGNIFICANT IMPACT

In accordance with the National Environmental Policy Act, the St. Paul District, Corps of Engineers has assessed the impacts of the following project.

Design Changes to Reach 1B of the
Rochester Flood Control Project
on the South Fork Zumbro River at
Rochester, Minnesota

The intent of the proposed changes is to facilitate construction of flood control features in reach 1B of the project, address aesthetic concerns recently identified by local authorities, and address the presence of contaminated soils in a portion of the project area. The design changes include: dewatering Silver Lake to facilitate modification of the dam and channel excavation, changes to shoreline stabilization plans around Mayo Memorial Park to alleviate aesthetic concerns, and special handling and disposal procedures for the excavation of contaminated soils. The design changes are described in Section 3.00 of the assessment. This Finding of No Significant Impact is based on the following factors: the proposed changes would have moderate and short-term impacts on fish and wildlife resources; the changes would have no impact on the cultural environment; the changes would have no impact on the social environment; the changes would have beneficial impacts on the aesthetic/recreation environment; and continued coordination will be maintained with State and Federal agencies. See Sections 1.00 and 5.00 of the assessment for a discussion of the impacts.

The environmental review process indicates that the proposed design changes do not constitute a major Federal action significantly affecting the quality of the environment. Therefore, an environmental impact statement will not be prepared.

_____
Date

Joseph Briggs
Colonel, Corps of Engineers
District Engineer

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B SUPPLEMENT

APPENDIX A
HYDRAULIC DESIGN

APPENDIX A
HYDRAULICS

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TABLES

PLATES

APPENDIX A

HYDRAULICS

1. **GENERAL** The South Fork Zumbro River channel is to be deepened and widened as discussed in Design Memorandum No. 2, the Feature Design Memorandum (FDM) for Stage 1B (Reference 1). The results presented in this supplement consist of adjustments to the FDM design to accommodate aesthetic/recreational design changes proposed by the City of Rochester. The study was done in order to determine the effects of the proposed aesthetic0 improvements on the design flood elevations along the reach from Silver Lake Dam (Sta. 127+00) to the N.E. Second Avenue bridge (Sta. 205+00). Only those features shown to not adversely affect the expected performance of the project were retained.

2. The selected plan for aesthetic/recreation design consists of bicycle paths on both sides of the river, a pedestrian bridge over the river, and five river access and/or overlook platforms. The bicycle path on the right bank includes underpasses at N.E. Seventh Street and East Center Street, which were included in the FDM. Some channel modification will be required on the left bank through Mayo Park. All of these features are discussed in detail in Paragraphs 4 through 8, and shown in detailed plan view in Plates 18 through 23 of the main report. Cross sections showing proposed channel modifications are presented in Plates 14 and 15 of the main report. Resulting revised water surface profiles are shown in Plate A-1. The maximum elevation increase over the FDM design is 0.14 foot, just downstream of the proposed pedestrian bridge.

3. **CHANGES FROM DESIGN MEMORANDUM NO. 2** The channel design with the proposed aesthetic0 and recreation features is very similar to that given in the FDM. The most significant changes involve the pedestrian bridge and bicycle paths at Mayo Park. The bridge will have two piers, each two feet wide. For the channel reach through Mayo Park, the channel shape will be changed to allow the bicycle path to more closely parallel the river The proposed river accesses will be recessed into the side of the channel and have

insignificant impact on flow. In addition to these minor channel modifications, there are changes in the riprap design, as discussed in detail in Paragraphs 9 and 10.

AESTHETIC FEATURES CONSIDERED

4. **Bicycle and Pedestrian Underpass at East Center Street** The recreation plan proposed by the City of Rochester included bicycle and pedestrian underpasses beneath East Center Street on both the left and right banks. These were incorporated into the HEC-2 model, and resulted in unacceptable stage increases The underpass on the left bank was eliminated and the bicycle path was rerouted to cross East Center Street. The HEC-2 model was revised again, and the resulting plan was shown to be acceptable.

5. **Channel Modifications through Mayo Park** The channel along Mayo Park will be modified to allow for a vertical retaining wall along the left bank, to allow the bicycle path to be placed closer to the river. The base of this retaining wall will intersect with a relocated bank of 1V:3H side slope. The HEC-2 model was revised to incorporate these changes. Model results show that the changes as shown in Plates 14 and 15 are acceptable, since the flow area below the design water surface is the same as that for the FDM design.

6. **Pedestrian Bridge at Mayo Park** The City plan included the proposed pedestrian bridge plus two plaza/overlook platforms which encroached significantly upon the channel. The HEC-2 model was revised to include these platforms, with a resulting upstream stage increase of approximately 0.5 foot for the design discharge. Upon removing the platforms from the design and adjusting the bridge opening so that the flow area below the design water surface is the same as that for the FDM channel without the bridge and piers, the resulting stage increases are less than 0.1 foot, and the pedestrian bridge is acceptable. The low chord has been designed to be at least three feet above the design water surface elevation, so no plugging is anticipated at this bridge.

7. **Raising Pedestrian and Bicycle Paths in Mayo Park** The pedestrian

and bicycle paths in Mayo Park can be raised to the design water surface elevation. For the design flood event, the FDM design allowed up to 200 cfs of flow in Mayo Park. The HEC-2 model was changed to prevent flow in the left overbank area in Mayo Park, with insignificant change in the design water surface profile.

8. **River Access Platforms** River access and/or overlook platforms are proposed for the left bank at stations 156+30, 160+30, 176+00, and 196+00, and for the right bank at 195+00. These will be recessed into the channel bank to minimize constriction of the flow.

EROSION PROTECTION

9. **Channel Riprap** Recent studies of bend riprap design (Reference 3) show that the criteria currently in use for bend riprap design may sometimes be too conservative. Accordingly, the riprap design given in the FDM was reviewed, with emphasis on bend riprap design, and revised where appropriate. Design for the straight channel reaches was found not to be in need of revision. W50 size for straight channel reaches remains based on EM 1110-2-1601, (Reference 2) while W50 size for bends is now based on WES Technical Report HL-88-4 (Reference 3). Layer thicknesses and gradations for both cases are based on criteria given in ETL 1110-2-120 for low turbulence. For reasons of economy, some gradations that were similar were combined. A larger riprap than the minimum was used for the bend at the Bear Creek Confluence (Sta. 195+50-198+65) to reduce the number of different gradations. The resulting channel riprap design is given in Table A-1. The design for both the channel and bridge riprap will be incorporated into the drawings during the plans and specifications phase, and will therefore not be included in the plates for this report.

10. **Bridge Riprap** Bridge riprap design is based on criteria given in References 2 and 4 for high turbulence. Thicknesses and gradations are given in Table A-2. Since the combined thickness of the riprap and bedding is

greater than the thickness of the bases of the piers for the North Broadway bridge, the N.E. Seventh Street bridge, and the East Center Street bridge (see Plates 37, 38, and 40 of the FDM), concrete footing protection will be required for these bridges to prevent undermining of piers during construction. The FDM recommends gabions for the North Broadway bridge and the East Center Street bridge. Since gabions are expensive and may have a relatively short life, the design given in Table A-2 is now being recommended instead. The design of the proposed footbridge, as shown in Plate 48 of the main report, indicates that no additional footing protection will be necessary for that bridge. The FDM design recommends gabions for the Dakota, Minnesota, and Eastern Railroad Bridge. Based on the velocity given in Table A-2 and the criteria given in Reference 2, the minimum required W50 size for this bridge is approximately 800 pounds, with a resulting layer thickness of 72 inches. This would not be a practical design. In light of this and previously stated reservations about the use of gabions, a concrete will be used under this bridge.

11. **CHANNEL MAINTENANCE** No changes in the maintenance requirements presented in the GDM are indicated as a result of design adjustments due to proposed aesthetic improvements.

12. **REFERENCES**

1. Design Memorandum No. 2, Feature Design Memorandum for Stage 1B, South Fork Zumbro River at Rochester, Minnesota. U.S. Army Corps of Engineers St. Paul District

2. EM 1110-2-1601, Hydraulic Design of Flood Control Channels. U.S. Army Corps of Engineers, OCE

3. WES Technical Report HL-88-4, Stable Riprap Size for Open Channel Flows. U.S. Army Corps of Engineers Waterways Experiment Station

4. ETL 1110-2-120, Additional Guidance for Riprap Channel Protection. U.S. Army Corps of Engineers, OCE

TABLE A-1
CHANNEL RIPRAP DESIGN

Nature of Reach	Station	Velocity (ft/sec)	(1) Thickness (inches)	Gradation (Pct. Lighter by Wt./ Stone Weight in Pounds)	Notes
straight	152+40-155+65	6.66	12	100: 86-35 50: 26-17 15: 13-5	(2)
straight	157+55-165+00	8.38	12	100: 86-35 50: 26-17 15: 13-5	
bend inside R=500'	165+00-173+05	12.01	18	100: 292-117 50: 86-58 15: 43-18	
bend outside R=500'	165+00-173+05	14.12	24	100: 691-276 50: 205-138 15: 102-43	(3)
straight	174+90-184+00	10.09	18	100: 292-117 50: 86-58 15: 43-18	(4)
bend inside R=300'	185+60-193+00	10.57	18	100: 292-117 50: 86-58 15: 43-18	(4)
bend outside R=300'	185+60-193+00	12.44	rock-fill	100: 691-276 50: 205-138 15: 102-43	(4)
straight	193+00-194+00	9.22	18	100: 292-117 50: 86-58 15: 43-18	(4)
bend R=200'	195+50-198+65	9.94 inside 11.69 outside	18	100: 292-117 50: 86-58 15: 43-18	
straight	198+65-204+70	6.90	12	100: 86-35 50: 26-17 15: 13-5	

Notes:

(1) - All layer thicknesses are for dry placement. For wet placement, increase layer thicknesses by 50 percent.

(2) - No riprap indicated for open areas of Silver Lake (downstream of Sta. 152+40)

(3) - Rock fill for outside of bend from Sta. 169+00 to 173+05.

(4) - Thicknesses and gradations increased per 1B FDM, Page A-13.

TABLE A-2
BRIDGE RIPRAP DESIGN

Bridge	Station	Velocity (ft/sec)	(1) Thickness (inches)	Gradation (Pct. Lighter by Wt./ Stone Weight in Pounds)	Notes
North Broadway	123+50-126+00	7.30	30	100: 400-160 50: 169-80 15: 84-25	
NE 7th Street	155+55-157+55	8.17	36	100: 691-276 50: 292-138 15: 146-43	
Dakota, Minn. and Eastern RR	173+05-174+90	11.99	Recommend concrete for this bridge.		
E. Center Street	183+45-185+60	9.41	48	100: 1638-655 50: 691-328 15: 346-102	
Proposed Footbridge	194+00-195+50	7.00	27	100: 292-117 50: 86-58 15: 43-18	(2)

Notes:

(1) - All layer thicknesses are for dry placement. For wet placement, increase layer thicknesses by 50 percent.

(2) - Gradation chosen to be same as for bend immediately upstream of bridge; thickness chosen to match this gradation for high-turbulence.

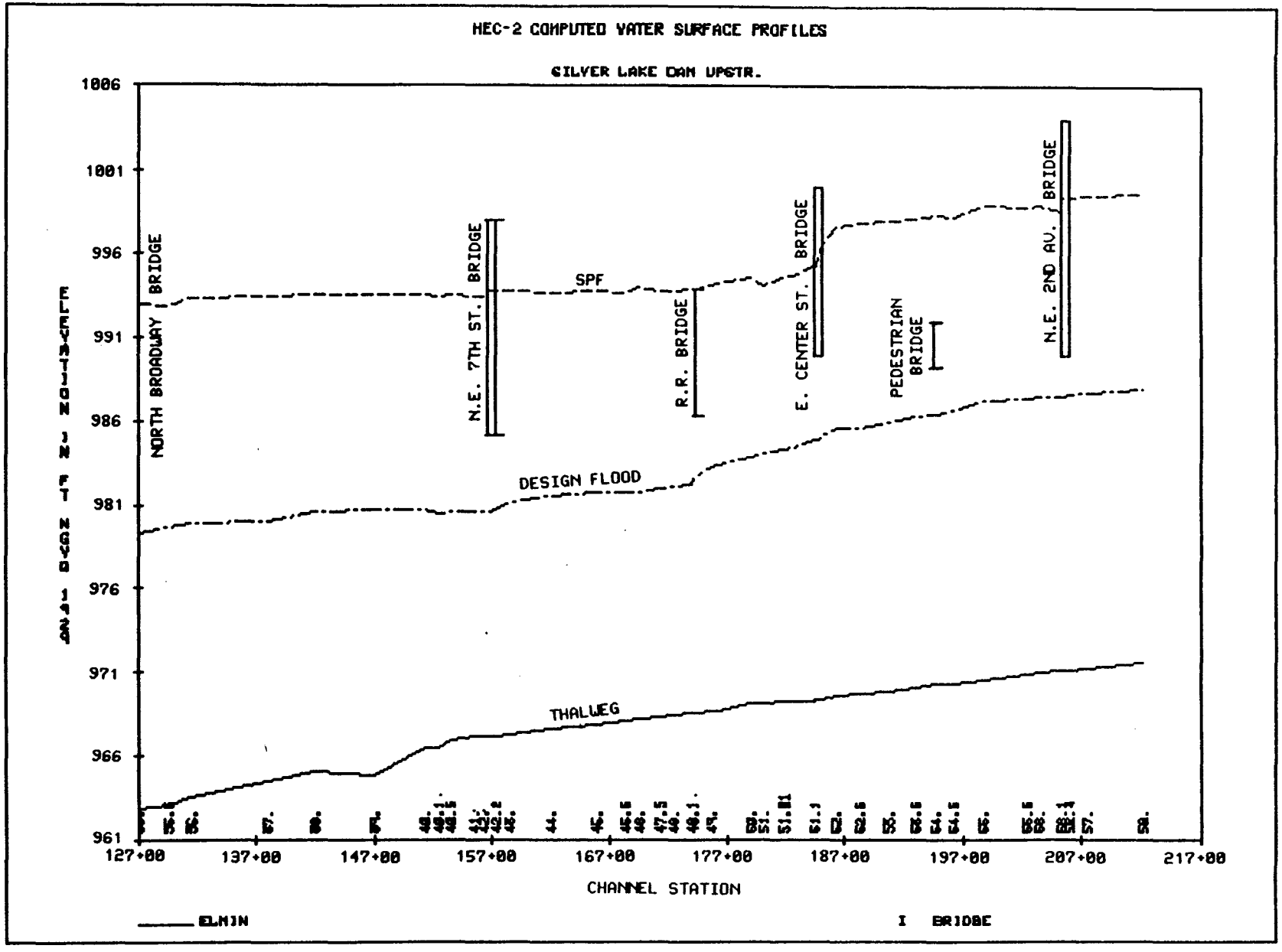

HEC-2 COMPUTED WATER SURFACE PROFILES
SILVER LAKE DAM UPSTR.
1006
1001
996
991
986
981
976
971
966
961
127+00
137+00
147+00
157+00
167+00
177+00
187+00
197+00
207+00
217+00
CHANNEL STATION
NORTH BROADWAY BRIDGE
N.E. 7TH ST. BRIDGE
SPF
R.R. BRIDGE
E. CENTER ST. BRIDGE
PEDESTRIAN BRIDGE
N.E. 2ND AV. BRIDGE
DESIGN FLOOD
THALWEG
ELMIN
I BRIDGE

PLATE A-1

APPENDIX B

GEOLOGY AND GEOTECHNICAL

APPENDIX B

TABLE OF CONTENTS

PLATES

55. AESTHETIC ALTERNATIVES

The Supplement to the FDM focused on aesthetic considerations for the 1B Reach. In the development of the selected aesthetic alternative, concrete retaining walls were designed. The geotechnical input to this design included the determination of soil parameters phi and the moist and saturated unit weights of the soils underlying the bases of the retaining walls, along with bearing capacity, sliding, and slope stability analyses for the designed structures. The soil parameters for the backfill materials were taken to be as indicated in Table B-6 in the FDM geotechnical design appendix. The insitu soils had the benefit of having some direct shear tests run on some of the samples.

56. FOUNDATION SOIL PARAMETERS

The elevation of the proposed footings lies at approximately the interface between the upper and lower alluvium designations used in the FDM. Table B-6 indicates a phi angle of 30 degrees, a moist unit weight of 115 pcf, and a saturated unit weight of 120 pcf for the upper alluvium and a phi angle of 36 degrees, a moist unit weight of 135 pcf, and a saturated unit weight of 138 pcf for the lower alluvium. Designing for a phi angle of 30 degrees appears to be somewhat conservative, while designing for a phi angle of 36 degrees appears to be optimistic.

An analysis of the average phi angle determined from the loose and dense direct shear tests when compared to the blow counts obtained at the sample depth indicates that a blow count of approximately 8 will result in an average phi angle of approximately 34 degrees.

The direct shear tests were performed on samples that were downstream of the area where the new walls are proposed. The borings in the design area indicate blow counts ranging from 2 to 24 at the proposed elevation of the footings. Without designing for worst case conditions and assuming the low blow counts are in concentrated areas of loose soils which could be bridged by the footings, the phi angle of 34 degrees indicated above was selected for the design of the proposed retaining walls.

57. BEARING CAPACITY

Bearing capacity for the footings was analyzed using the Corps CBEAR computer program. Loads were obtained from structural computations shown in Appendix C, Structural Analysis and Design. The sum of the vertical loads and the sum of the horizontal loads were combined to form a resultant applied load on the footing. The eccentricity and angle of inclination of the load were also determined prior to running the CBEAR computer program. Since CBEAR gives ultimate bearing capacity in pounds per square foot, the results were multiplied by the effective footing width and divided by the applied vertical load to obtain a factor of safety. Factors of safety greater than 3.0 were obtained for all designs. CBEAR takes into account inclined loads, eccentricity, and sloping ground. Since the banks or side slopes of the proposed channel do not slope continuously, but only on one side of the footing for a short distance, the factors of safety obtained are conservative.

A sample CBEAR output for Station 203+00 is shown on Plates B-81 and B-82, along with the resultant factor of safety calculation.

58. SLOPE STABILITY

The stability of the slopes under the new applied loads on the proposed footings was analyzed using the St. Paul District computer program I0013 (formerly a Corps Library Program). The considerations mentioned in the FDM for slope stability also apply for the proposed walls. Therefore, long and short term strength parameters are considered equal. In addition, the entire 1B reach is within the pool of Silver Lake Dam, resulting in a normal water surface elevation of 974.

A typical slope stability analysis was performed for Station 203+00 on the left bank. The critical circles for tangent elevations of 955, 960, 965, and 970 are shown on Plate B-83.

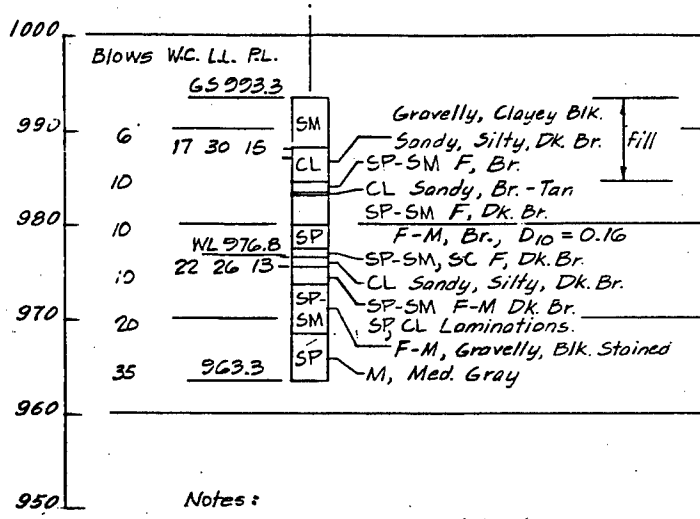
The critical circle occurred at a tangent elevation of 965.00 and had a factor of safety of 2.33, which exceeds the required factor of safety of 1.40. The water table elevation for the critical circle was varied from the channel bottom elevation of 970.92, representing a dry pool behind Silver Lake Dam, to an elevation of 980, representing intermediate river stage, resulting in factors of safety greater than that for the critical circle with a water table elevation of 974, which represents normal pool.

The critical circle is shown on Plate B-84. The force polygon for the critical circle is shown on Plate B-85 and the slice data is shown on Plate B-86.

59. FUTURE SUBSURFACE INFORMATION

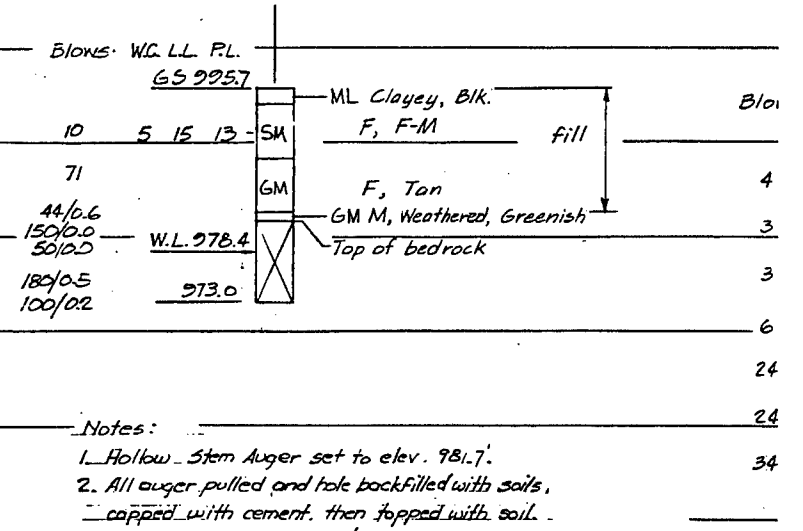
Due to the proposed aesthetic structural features in the Mayo Park area, additional subsurface information will be required as part of the plans and specifications work for this reach. In addition, several additional direct shear tests will be performed on samples obtained from the new borings to verify the design assumptions made during the FDM and Supplement to the FDM.

84-66M
17 Oct. 1984



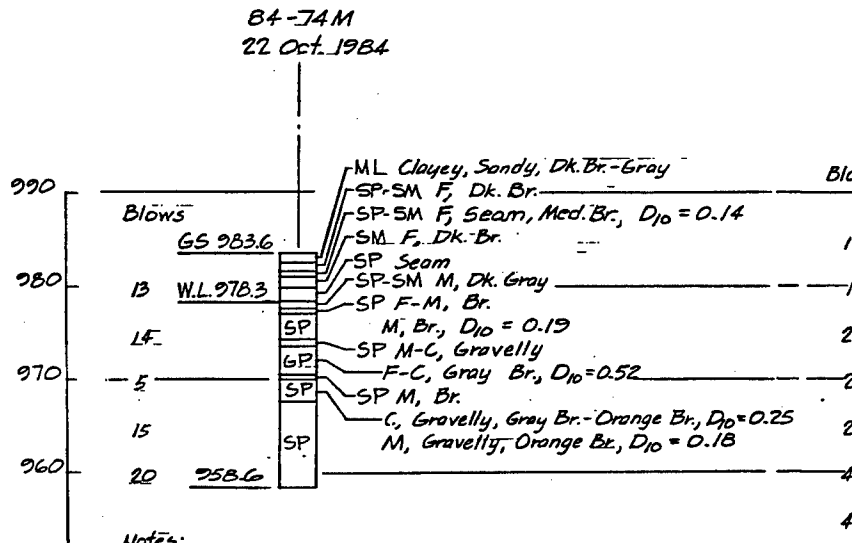
Notes:
1. Hollow Stem Auger set to elev. 974.3. Hole stabilized with drilling mud below elev. 973.3.
2. All auger pulled and hole backfilled with soils and capped with cement.
3. Boring location - Topog Drg. M30-S-10/85.

84-67M
17 Oct. 1984



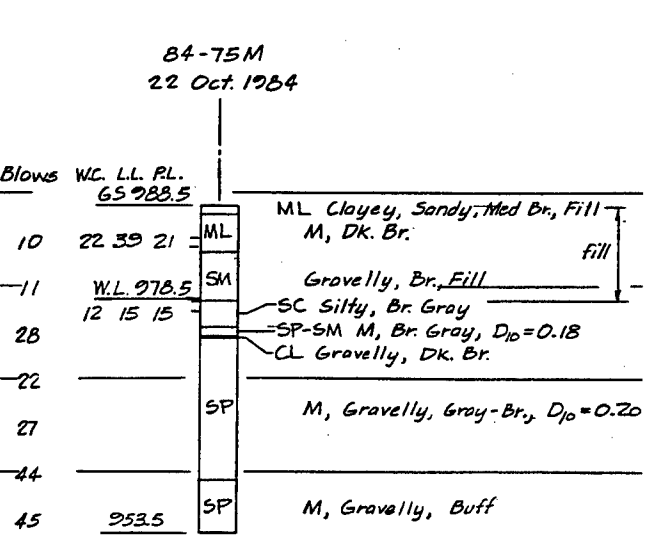
Notes:
1. Hollow Stem Auger set to elev. 981.7'.
2. All auger pulled and hole backfilled with soils, capped with cement, then topped with soil. 80% water loss @ 18.0'.
3. Boring location - Topog. Drg. M30-S-10/86.

84-74M
22 Oct. 1984



Notes:
1. W.S. of river adjacent to boring = 978.2
2. Hollow Stem Auger set to elev. 967.1 Hole stabilized with drilling mud below elev. 973.6
3. All auger pulled and hole backfilled with soils and capped with cement.
4. Boring location - Topog Drg. M30-S-10/88.

84-75M
22 Oct. 1984



Notes:
1. W.S. of river adjacent to boring = 978.26
2. Hollow Stem Auger set to elev. 974.0. Hole stabilized with drilling mud below elev. 973.5.
3. All auger pulled and hole backfilled with soils and capped with cement.
4. Boring location - Topog Drg. M30-S-10/87

C D E F

84-67 M
Oct. 1984

ML Clayey, Blk. F, F-M — fill
F, Tan
GM M, Weathered, Greenish
Top of bedrock

ger set to elev. 981.7'.
' and hole backfilled with soils,
ment. then topped with soil.
s @ 18.0'.
- Topog. Drg. M30-5-10/86.

84-68 M
18 Oct. 1984

Blows		
	GS 990.1	Asphalt Parking Lot
4		GM Sandy, Tan Sl. Silty, Orange Br.
3	W.L. 978.6	ML Seam F-M, Silty, Orange Br.
3		ML Seam — Fill
6		F-M, Silty, Orange Br.
24		SP, F-M, Silty, Gray F-M, Silty, Blk.-Dk. Gray
24		SP, F-M, Med. Gray SW-SM Seam
34	955.1	F-M, Dk. Gray, Interbedded Seams F-M, Gray - Br.

Notes:
1. W.S. of river adjacent to boring = 978.8
2. Hollow Stem Auger set to elev. 976.1. Hole stabilized with drilling mud below elev. 975.1
3. All auger pulled and hole backfilled with soils and capped with cement.
4. Boring location - Topog. Drg. M30-5-10/86.

84-73M
22 Oct. 1984

Blows		
	GS 985.5	ML Topsoil,
22	W.L. 978.1	SC Silty, Fill,
4		SM Clayey,
4		CL Silty, San
17		SP-SM M,
19		SP M, Br. G
29	955.5	SP-SM Seam SP M, Br. Gr SP F-M, S M

Notes:
1. Hollow Stem Auger set to elev
Hole stabilized with drilling mud
2. Boring location - Topog Drg. M3

84-75M
22 Oct. 1984

L. P.L. 988.5

9 21 — ML Clayey, Sandy, Med Br., Fill M, Dk. Br. — fill
978.5
5 15 — SM Gravelly, Br., Fill
SC Silty, Br. Gray
SP-SM M, Br. Gray, D_{10} = 0.18
CL Gravelly, Dk. Br.
SP M, Gravelly, Gray-Br., D_{10} = 0.20
53.5 — SP M, Gravelly, Buff

Blows
13
24
11
19
36
29
25

of river adjacent to boring = 978.26
w Stem Auger set to elev. 974.0.
stabilized with drilling mud below elev. 973.5.
uger pulled and hole backfilled with soils
capped with cement.
ng location - Topog Drg. M30-5-10/87

84-76M
24 Oct. 1984

	GS 985.8	
SM		Asphalt Fill, Dk. Br. - Blk.
SM	W.L. 977.8	Fill — Gravelly, Dk. Br., Fill
GP-SP		Saturated w/Blk. Oily Sludge
		SP-SM F, Blk. Oily, Scattered Grav. Seams
		SP M-C, Blk. Oily Stained
SP		F-M, Blk. Oily Stained
SP	950.8	F-M, Dk. Gray - Buff

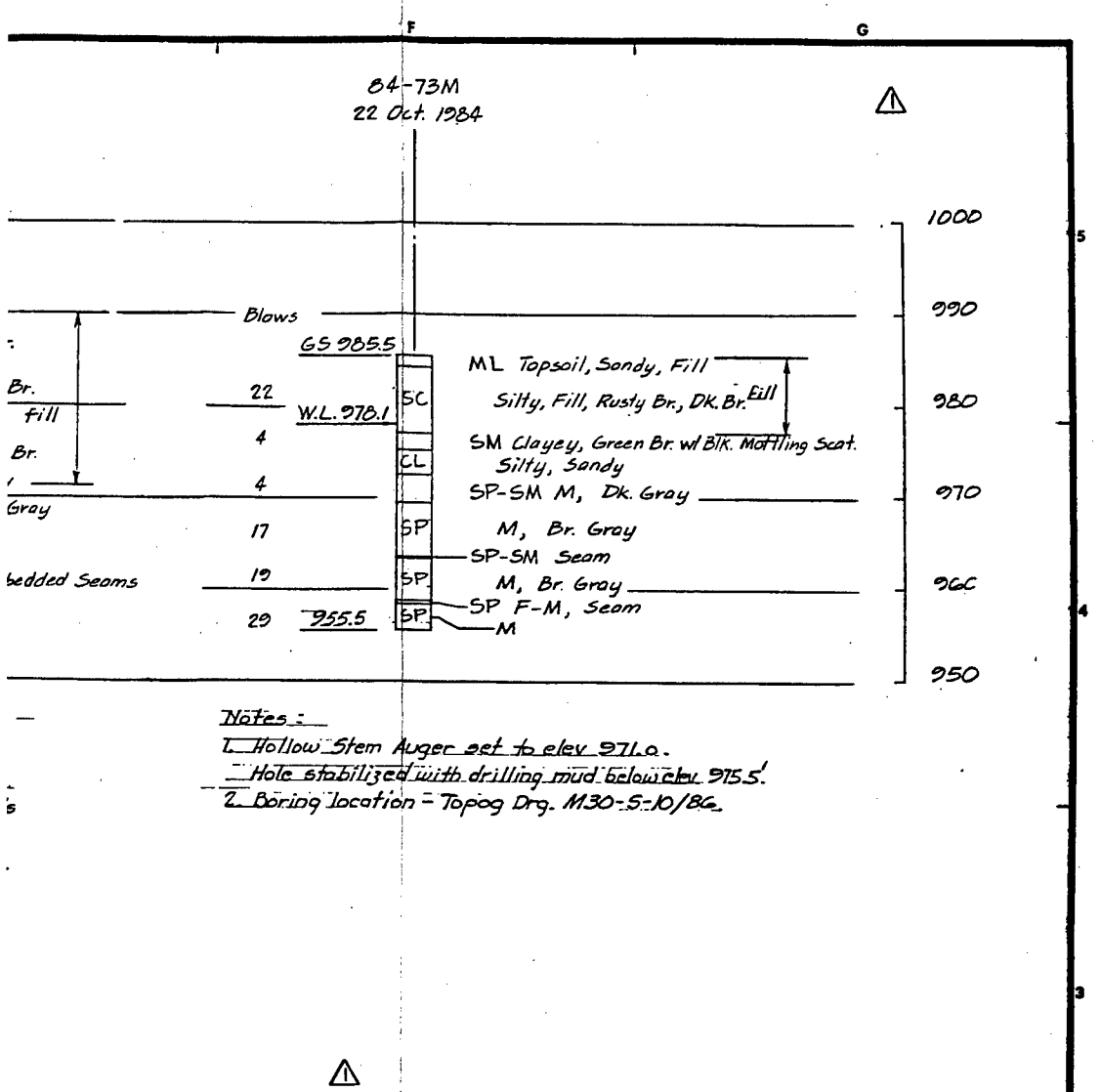
990
980
970
960
950
940

Notes:
1. W.S. of river adjacent to boring = 978.48.
2. Hollow Stem Auger set to elev. 966.3. Hole stabilized with drilling mud below elev. 959.9.
3. All auger pulled and hole backfilled with soils, and capped with cement.
4. Samples saturated with black oily sludge.
5. Boring location - Topog Drg. M30-5-10/85

⚠	Revised
SYMBOL	

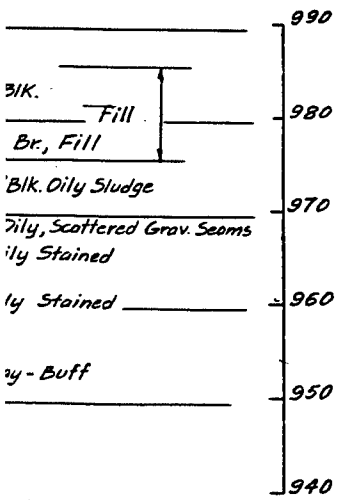
DESIGNED BY: R.B.F.	DE
DRAWN BY: M.S.R.	S.
CHECKED BY:	
SUBMITTED BY:	
CHIEF BRANCH	AP
CHIEF BRANCH	

C D E F



Notes:

1. Hollow Stem Auger set to elev 971.0.
   Hole stabilized with drilling mud below elev 915.5.
2. Boring location = Topog Drg. M30-5-10/86.



= 978.48.
6.3.
low elev. 959.9.
ed with soils,

ily sludge.
-5-10/85

SYMBOL	DESCRIPTION	DATE	APPROVAL
⚠	Revised	Nov 88	G.V.F.

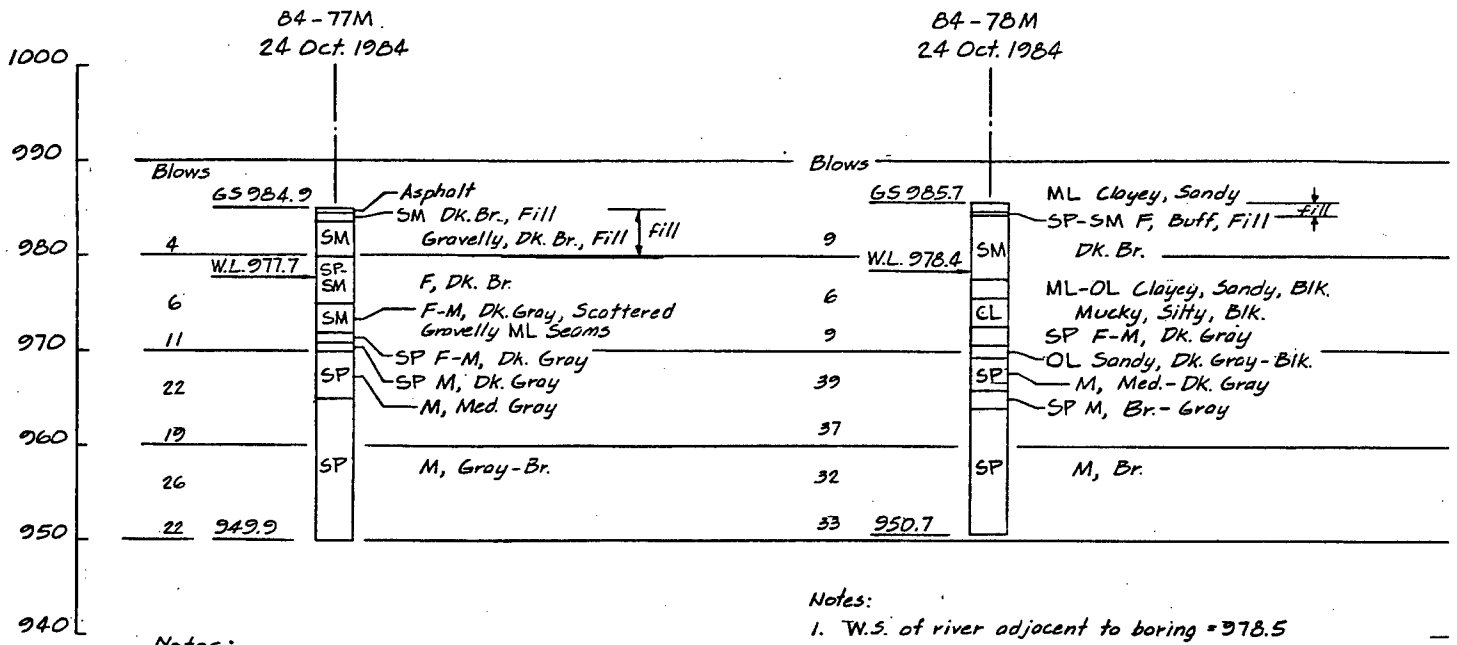
DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: R.B.F.
DRAWN BY: M.S.R.
CHECKED BY:
SUBMITTED BY:
CHIEF BRANCH
CHIEF BRANCH
APPROVED BY:
CHIEF ENGR. DIVISION

DESIGN MEMORANDUM NO. 2 PHASE IB, FEATURE
APPENDIX - B
FLOOD CONTROL - MISSISSIPPI RIVER
S. FORK ZUMBRO RIVER - ROCHESTER, MINNESOTA
ROCHESTER
BORING LOGS 84-66M THRU 84-76M

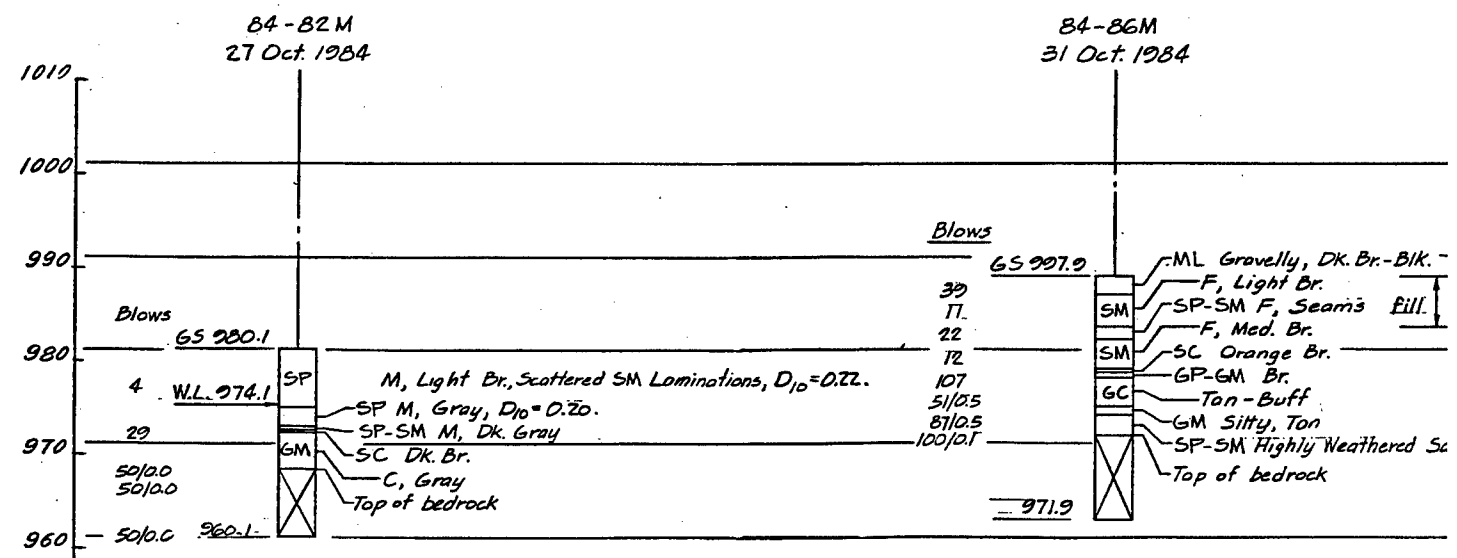
DATE: JANUARY 1987
SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER
SHEET OF

PLATE B-7



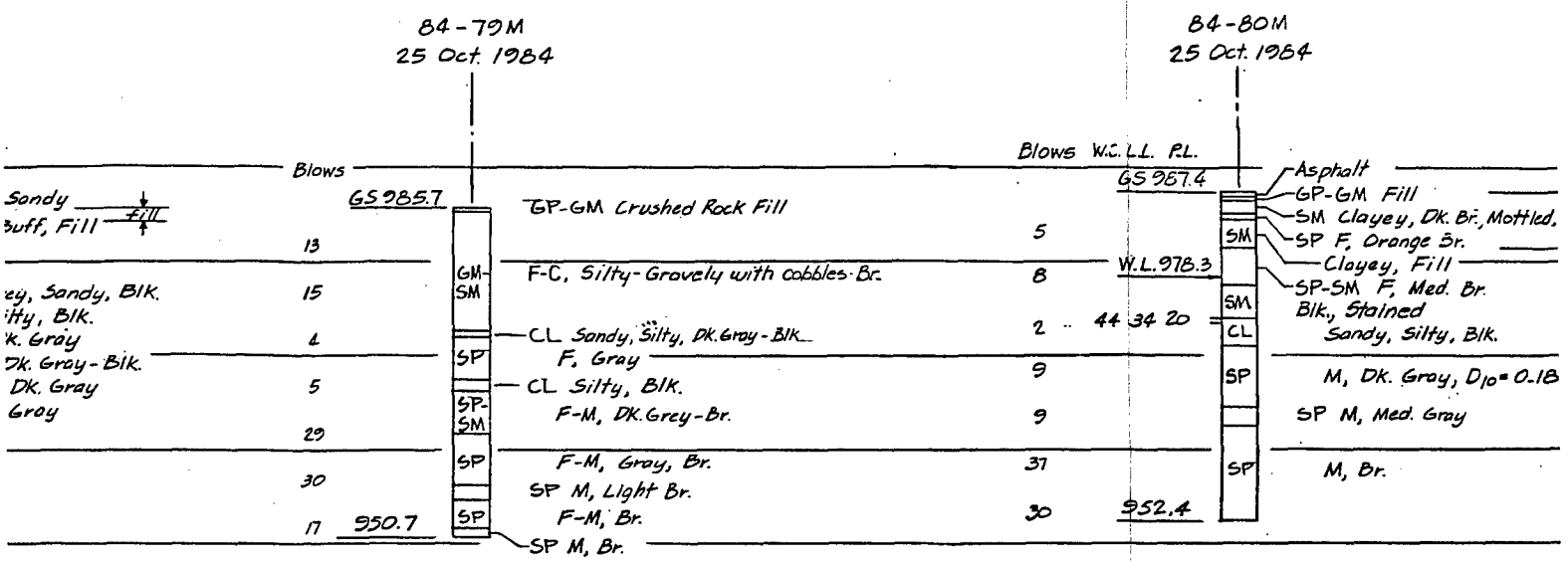
Notes:
1. Hollow Stem Auger set to elev. 970.4
Hole stabilized with drilling mud below elev. 969.9.
2. All auger pulled and hole backfilled with soils
and capped with cement.
3. Boring location - Topog Drg. M30-5-10/86

Notes:
1. W.S. of river adjacent to boring = 978.5
2. Hollow Stem Auger set to elev. 976.2.
Hole stabilized with drilling mud below elev. 975.7
3. All auger pulled and hole backfilled with soils
and capped with cement.
4. Boring location - Topog Drg. M30-5-10/86



Notes:
1. W.S. of Silver Lake adjacent to boring = 973.98
2. Hollow Stem Auger set to elev. 970.6.
Hole stabilized with drilling mud below elev. 970.1.
3. Boring location - Topog Drg. M30-5-10/85.

Notes:
1. Hollow Stem Auger set to elev. 983.4
Hole stabilized with drilling mud below elev. 982.
2. All auger pulled and hole backfilled with soils.
3. Boring location - Topog. Dwg. M30-5-10/86.



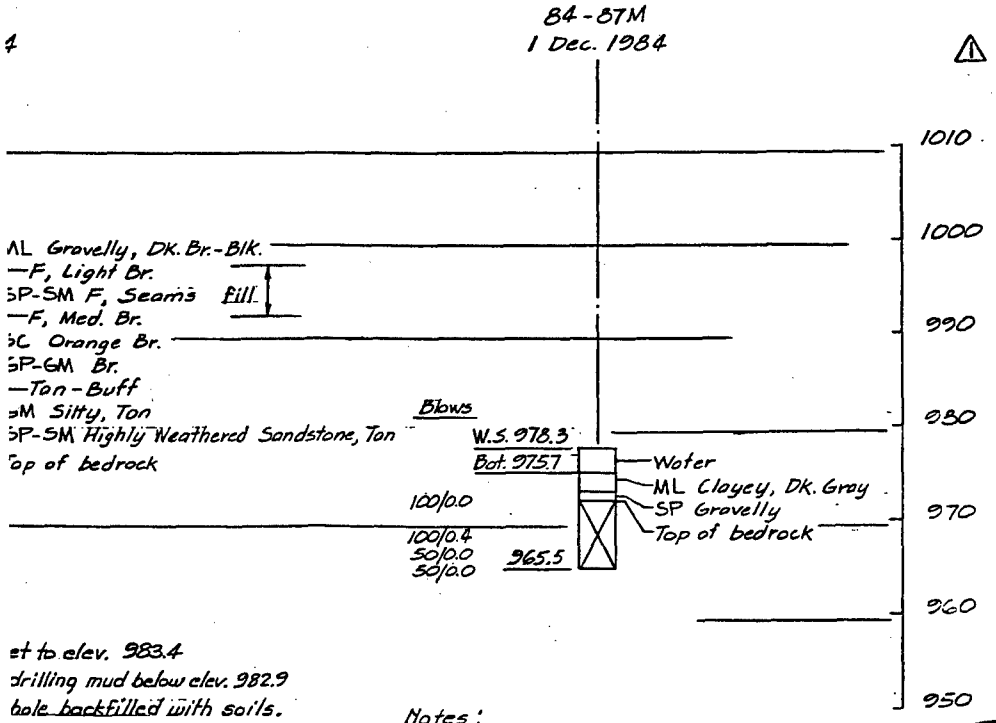
ng = 978.5
976.2
d below elev. 975.7
illed with soils

0-5-10/86

Notes:
1. Hollow Stem Auger set to elev. 971.7
Hole stabilized with drilling mud below elev. 971.2.
2. All auger pulled and hole backfilled with soils and capped with cement.
3. Poor sample recovery 0-10' due to course gravel and cobble fill plugging or obstructing soils.
4. Abundant voids in soils between gravel/cobbles 1'-13'.
5. Boring location - Topog Drg. M30-5-10/87

Notes:
1. W.S. of river adjacent to boring = 978.5
2. Hollow Stem Auger set to elev 972.9
Hole stabilized with drilling mud below elev
3. All auger pulled and hole backfilled with so and capped with cement.
4. Boring location - Topog Drg. M30-5-10/86.

4



et to elev. 983.4
drilling mud below elev. 982.9
bole backfilled with soils.
g Dwg. M30-5-10/86.

Notes:
1. W.S. of river adjacent to boring 978.3.
2. 4" casing set to elev. 972.4.
3. Water loss at 12.7'.
4. Boring location - Topog Dwg. M30-5-10/86.

SYMBOL	DESCRIPTION
⚠	Revised

DEPA
ST. PAU

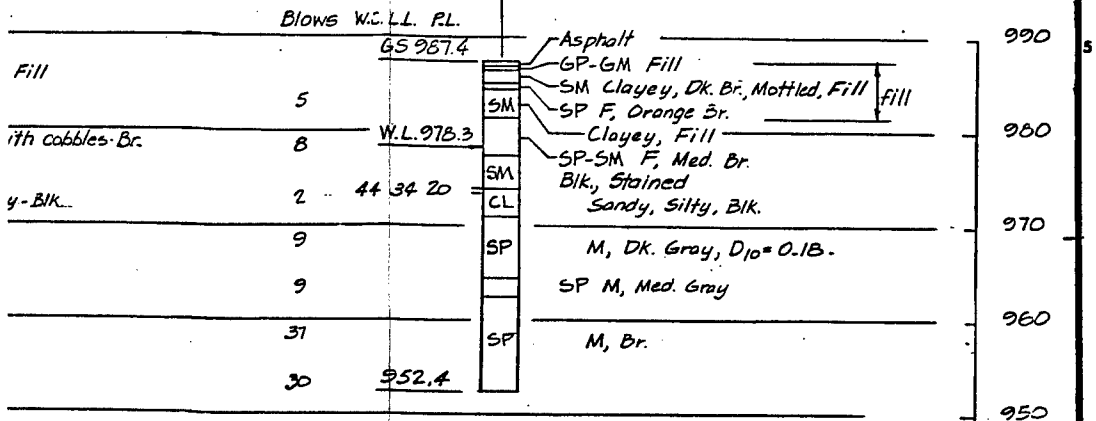
DESIGNED BY: R.B.F.
DRAWN BY: M.S.R.
CHECKED BY:
SUBMITTED BY:
CHIEF BRANCH
CHIEF BRANCH
APPROVED BY:
CHIEF ENGR. DIVISION

DESIGN MEMORANDUM NO.
FLOOD CONTROL - MI
S. FORK ZUMBRO RIVER - I
ROCHE
BORING LOGS 84-77

SCALE: AS
SHEET

F G

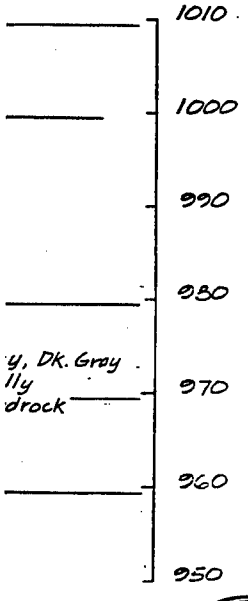
84-80M
25 Oct. 1984



Notes:

1. W.S. of river adjacent to boring = 978.5
2. Hollow Stem Auger set to elev 972.9. Hole stabilized with drilling mud below elev 972.4
3. All auger pulled and hole backfilled with soils and capped with cement.
4. Boring location - Topog. Drg. M30-5-10/86.

elev. 971.2.
soils
rse gravel
soils.
l/cobbles 1'-13'.
'87



y, Dk. Gray
lly
drock

ing 978.3.

M30-5-10/86.

SYMBOL	DESCRIPTION	DATE	APPROVAL
⚠	Revised	Nov 88	G.V.F.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: R.B.F.
DRAWN BY: M.S.R.
CHECKED BY:
SUBMITTED BY:
CHIEF BRANCH
CHIEF BRANCH

DESIGN MEMORANDUM NO. 2 PHASE IB, FEATURE
APPENDIX - B
FLOOD CONTROL - MISSISSIPPI RIVER
S. FORK ZUMBRO RIVER - ROCHESTER, MINNESOTA
ROCHESTER
BORING LOGS 84-77M THRU 84-87M

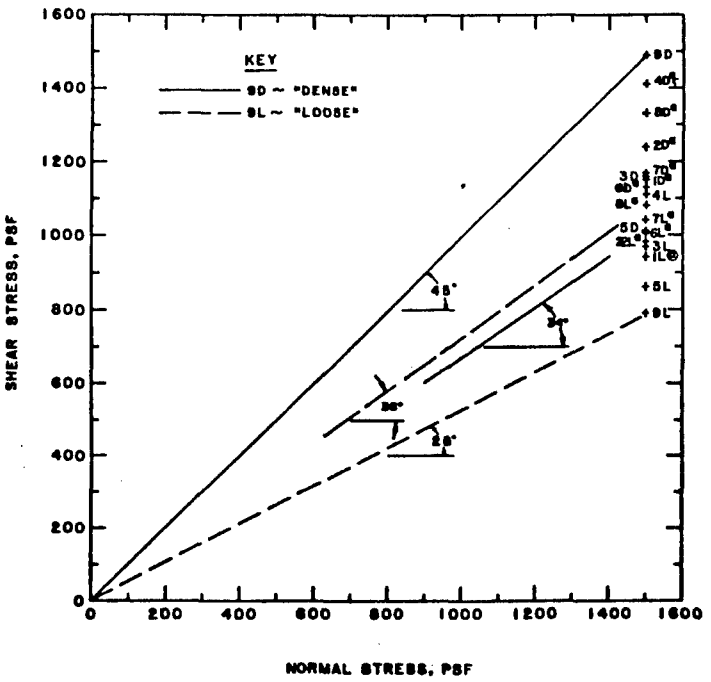
APPROVED BY:
CHIEF ENGR. DIVISION

DATE: JANUARY 1987

SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER
SHEET OF

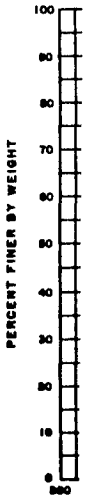
E F

PLATE B-8



DESIGN SHEAR STRESS VERSUS NORMAL STRESS

U.S. S

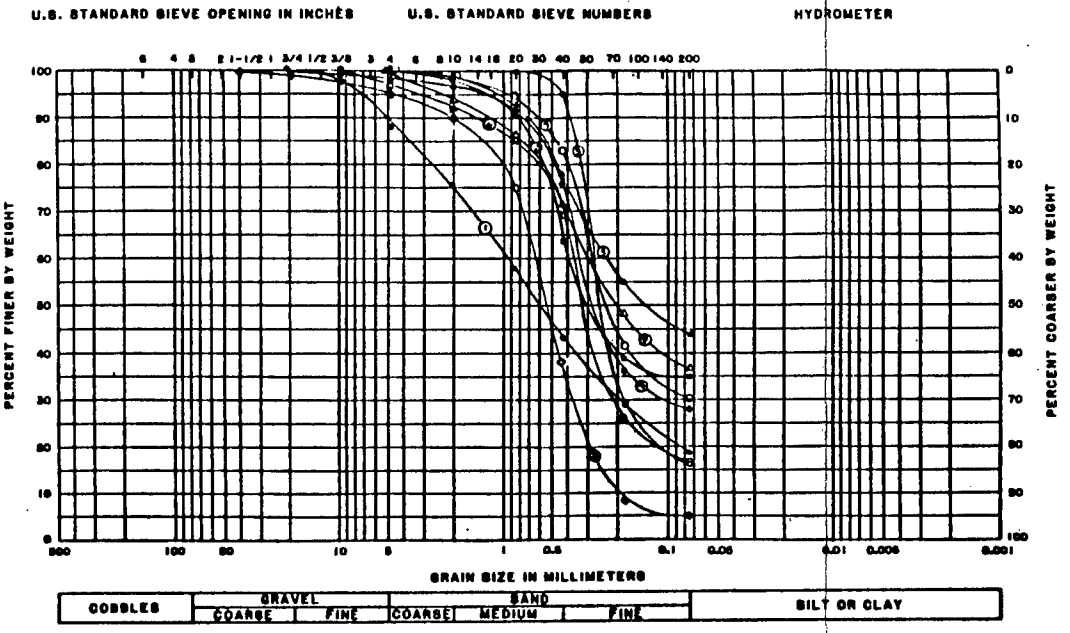


SAMPLE NO.			B3-88M-1/2		B3-87M-1/2		B4-68M-1/2		B4-68M-3/4		B4-77M-1/2		B4-77M-3/4		B4-78M-1/2		B4-78M-7/8		B4-80
TEST NO.			1D	1L	2D	2L	3L	3D	4D	4L	5L	5D	6D	6L	7D	7L	8D	8L	9L
INITIAL	WATER CONTENT	W_o	7.5%	3.3%	10.7%	2.5%	2.0%	11.9%	15.6%	7.9%	0.98%	5.8%	7.1%	3.0%	12.3%	4.0%	8.0%	0.43%	1.4%
	VOID RATIO	C_o	0.41	1.11	0.38	1.08	1.02	0.47	0.45	1.66	1.09	0.55	0.46	1.29	0.74	1.34	0.81	0.72	0.95
	SATURATION	S_o	49.0%	8.0%	77.0%	6.4%	5.4%	68.0%	94.0%	13.0%	2.4%	28.0%	42.0%	6.2%	4.3%	7.8%	42.0%	1.6%	4.0%
	DRY DENSITY, LB/CU FT	γ_d	119.1	79.8	122.5	81.0	83.8	114.4	118.6	83.4	80.7	108.8	118.8	73.6	92.7	66.8	111.4	98.1	84.0
VOID RATIO AFTER CONSOLIDATION		C_c	0.41	1.11	0.38	1.08	1.02	0.47	0.45	1.07	1.09	0.55	0.46	1.29	0.74	1.34	0.81	0.72	0.95
TIME FOR 50 % CONSOLIDATION, MIN																			
FINAL	WATER CONTENT	W_f	14.4%	15.7%	14.1%	15.6%	20.4%	17.8%	15.8%	15.8%	15.8%	16.1%	16.0%	16.7%	23.1%	25.7%	15.7%	15.8%	15.6%
	VOID RATIO	C_f	0.34	1.12	0.29	1.08	0.96	0.48	0.38	1.09	1.03	0.55	0.40	1.29	0.65	1.32	0.81	0.73	0.89
	SATURATION	S_f	100%	38%	100%	39%	57%	100%	100%	40%	40%	79%	100%	35%	92%	50%	84%	70%	55%
NORMAL STRESS, T/SQ FT		σ	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
DESIGN SHEAR STRESS, T/SQ FT		τ	@ 0.576	@ 0.470	@ 0.618	@ 0.490	0.487	0.578	@ 0.705	@ 0.555	0.430	0.505	@ 0.564	@ 0.503	@ 0.562	@ 0.520	@ 0.666	@ 0.558	0.396
ACTUAL TIME TO FAILURE, MIN		t_f	1265	1260	1020	240	420	120	1440	420	1020	360	660	360	900	1320	420	300	300
RATE OF STRAIN, IN/MIN X .0001			3.95	3.94	3.93	3.80	4.62	3.82	3.28	4.47	4.44	4.20	4.17	5.17	3.77	3.64	4.60	3.87	4.14
ULTIMATE SHEER STRESS, T/SQ FT		τ_{ULT}	@ 0.575	@ 0.528	@ 0.572	@ 0.541	0.464	0.506	@ 0.551	@ 0.703	0.433	0.483	@ 0.432	@ 0.429	@ 0.573	@ 0.566	@ 0.577	@ 0.481	0.378
LIQUID LIMIT		L.L.	N.P.		27		27		N.P.		N.P.		N.P.		36		-		2
PLASTIC LIMIT		P.L.	N.P.		13		13		N.P.		N.P.		N.P.		. 19		-		1

DIRECT SHEAR TEST RESULTS
SUMMARY

NOTES:

1. SAMPLE NUMBERS REFER TO SACKS OF MATERIAL COMBINED FROM 8 IN. DIA. TUBE SAMPLES.
2. @ SAMPLE DESIGNATION L = "LOOSE" D = "DENSE"
3. @ INDIVIDUAL TEST RESULTS AND STRESS STRAIN CURVES PRESENTED ON PLATES B-38 THROUGH B-46.



DIRECT SHEAR TEST SAMPLE

GRAIN – SIZE DISTRIBUTION CURVES

-3/4	84-78M-1/2		84-78M-7/8		84-80M-1/2	
6L	7D	7L	8D	8L	9L	9D
.0%	12.3%	4.0%	8.0%	0.43%	1.4%	8.5%
.29	0.74	1.34	0.61	0.72	0.95	0.29
.2%	4.3%	7.8%	42.0%	1.6%	4.0%	86.0%
3.6	92.7	88.9	111.4	98.1	84.0	126.5
.29	0.74	1.34	0.61	0.72	0.95	0.29
5.7%	23.1%	25.7%	15.7%	18.9%	18.6%	13.8%
.29	0.85	1.32	0.61	0.73	0.89	0.31
5%	92%	80%	84%	70%	55%	100%
.75	0.75	0.75	0.75	0.75	0.75	0.75
.503	0.562	0.520	0.666	0.558	0.396	0.744
360	900	1320	420	300	300	240
3.17	3.77	3.64	4.60	3.57	4.14	3.27
.489	0.573	0.556	0.577	0.481	0.378	0.624
	36		-		21	
	19		-		10	

ⓒ	LAB TEST DATA CORRECTION	10-5
SYMBOL	DESCRIPTION	DA

DEPARTMENT OF THE
ST. PAUL DISTRICT, CORPS OF E
ST. PAUL, MINNESOTA

DESIGNED BY: R.B.F.
DRAWN BY: M.S.R.
CHECKED BY:
SUBMITTED BY:

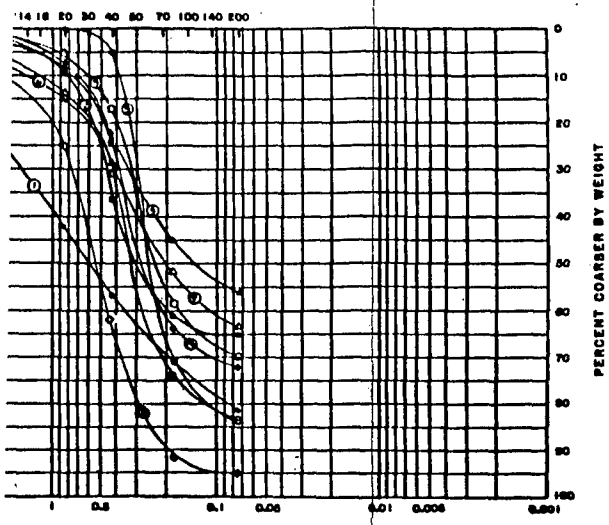
DESIGN MEMORANDUM NO. PHASE
APP
FLOOD CONTROL - MISSISSIPPI RIVER
S. FORK ZUMBRO RIVER - ROCHESTER, M
ROCHESTER
DIRECT SHEAR TEST RESULT

APPROVED BY:
DATE: JANU

SCALE: AS SHOWN
SPEC. NO.
DRAWING NUM
SHEET OF

SAFETY DAYS

ANDARD SIEVE NUMBERS HYDROMETER



IN SIZE IN MILLIMETERS

SAND			SILT OR CLAY
MEDIUM	FINE		

CT SHEAR TEST SAMPLE
SIZE DISTRIBUTION CURVES

SYMBOL	DESCRIPTION	DATE	APPROVAL
⓪	LAB TEST DATA CORRECTION	10-5-87	R.B.F.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY: R.B.F.
DRAWN BY: M.S.R.
CHECKED BY:
SUBMITTED BY:
APPROVED BY:

DESIGN MEMORANDUM NO. PHASE , FEATURE
APPENDIX - B
FLOOD CONTROL - MISSISSIPPI RIVER
S. FORK ZUMBRO RIVER - ROCHESTER, MINNESOTA
ROCHESTER
DIRECT SHEAR TEST RESULTS

DATE: JANUARY 1987
SCALE: AS SHOWN
DRAWING NUMBER
SHEET OF

PLATE B-50

U.S. Army Engineer Waterways Experiment Station

CBEAR/PC - BEARING CAPACITY ANALYSIS
FOUNDATION AND SOIL DESCRIPTIONS

* FOUNDATION GEOMETRY WIDTH = 16.00 LENGTH = 1.00

LEFT SIDE: ELEV. (ft)	X-COORD. (ft)	RIGHT SIDE: ELEV. (ft)	X-COORD. (ft)
0.00	0.00	0.00	16.00

FOUNDATION TYPE : CONTINUOUS PRESSURE TYPE : GROSS

* SOIL DATA

LEFT SIDE: ELEV. (ft)	X-COORD. (ft)	RIGHT SIDE: ELEV. (ft)	X-COORD. (ft)
7.26	0.00	12.62	16.00

FRICTION ANGLE (deg)	COHESION (psf)	UNIT WEIGHT MOIST (pcf)	UNIT WEIGHT SATURATED (pcf)
34.0	0.00	135.0	138.0

U.S. Army Engineer Waterways Experiment Station

CBEAR/PC - BEARING CAPACITY ANALYSIS

* SURCHARGE DESCRIPTION
(option not selected)

LAYER NO.	SURFACE ELEVATION (ft)	UNIT WEIGHT MOIST (pcf)	UNIT WEIGHT SAT. (pcf)
1	*******	***	***
2	*******	***	***

* SUBSOIL DESCRIPTION
(option not selected)

ELEVATION (feet)	FRICTION ANGLE	COHESION (psf)	UNIT WT. MOIST	UNIT WT. SAT.
*******	***	****	***	***

---

* WATER TABLE DESCRIPTION

WATER TABLE ELEVATION : 2.3 (ft)

UNIT WEIGHT OF WATER : 62.4 (pcf)

* APPLIED LOAD DESCRIPTION

APPLIED LOAD	: 32239.4	(kips)
X-COORD. of LOAD	: 6.36	(ft)
Z-COORD. of LOAD	: 0.50	(ft)
ANGLE of INCLINAT.	: 20.9	(deg.)

U.S. Army Engineer Waterways Experiment Station

CBEAR/PC - BEARING CAPACITY ANALYSIS

* EFFECTIVE BASE DIMENSIONS : WIDTH = 12.72 LENGTH = 1.00

PLATE B-81

*** SUMMARY OF BEARING CAPACITY FACTORS ***

FACTORS	C	Q	G	BEARING CAPACITY (kips/ft**2)
BEARING CAP.	42.16	29.44	31.15	54.268
SHAPE - CONC.	1.00000	1.00000	1.00000	54.268
SHAPE ECC.	1.00000	1.00000	1.00000	50.406
INCLINATION	0.58948	0.58948	0.14845	23.109
BASE TILT	1.00000	1.00000	1.00000	23.109
GROUND SLOPE	0.42261	0.44223	0.44223	7.057
EMBEDMENT	1.17068	1.08534	1.08534	7.660

	FNC	+	FNQ	+	FNG	=	Q
COMBINE EFFECTS of FACTORS	0.000		6.593		1.067		7.660

Factor of Safety Calculation

$$FS = \frac{Q \times \text{Eff. Width}}{\Sigma \text{ Vert. Loads}}$$

$$FS = \frac{7.660 \times 12.72}{32.239}$$

$$FS = 3.022 \rightarrow OK$$

Plate B-82

ROCHESTER 1B STA 203 STABILITY ANALYSIS

FILE: ROCHPLOT

7 JUL 88

ARC	XCEN	YCEN	RAD	FS
1	999.4	1035.	65.3	3.16
2	1005.	997.3	32.3	2.33
3	1010.	999.5	39.4	2.57
4	1014.	1002.	47.2	3.33

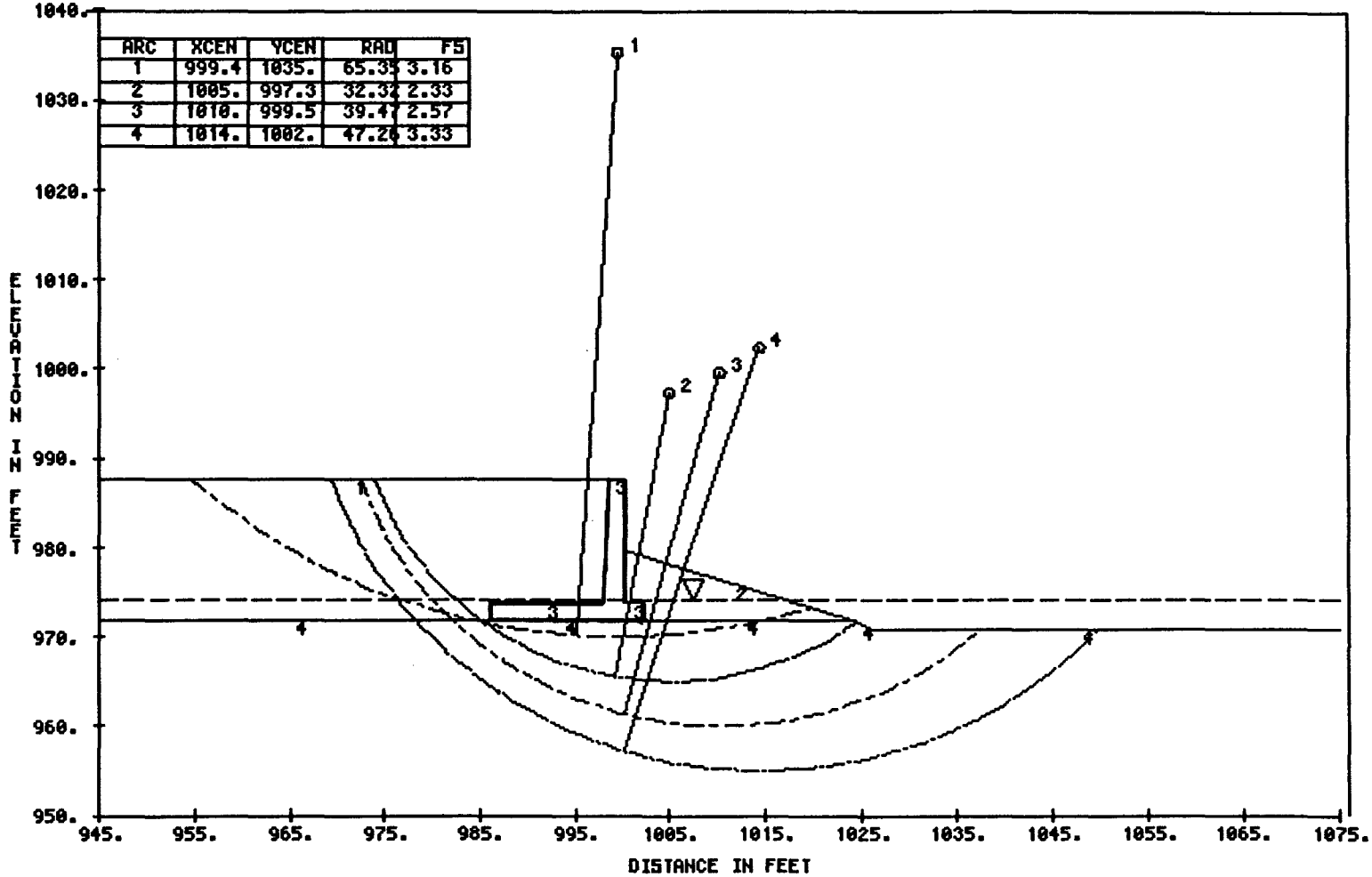


PLATE B-83

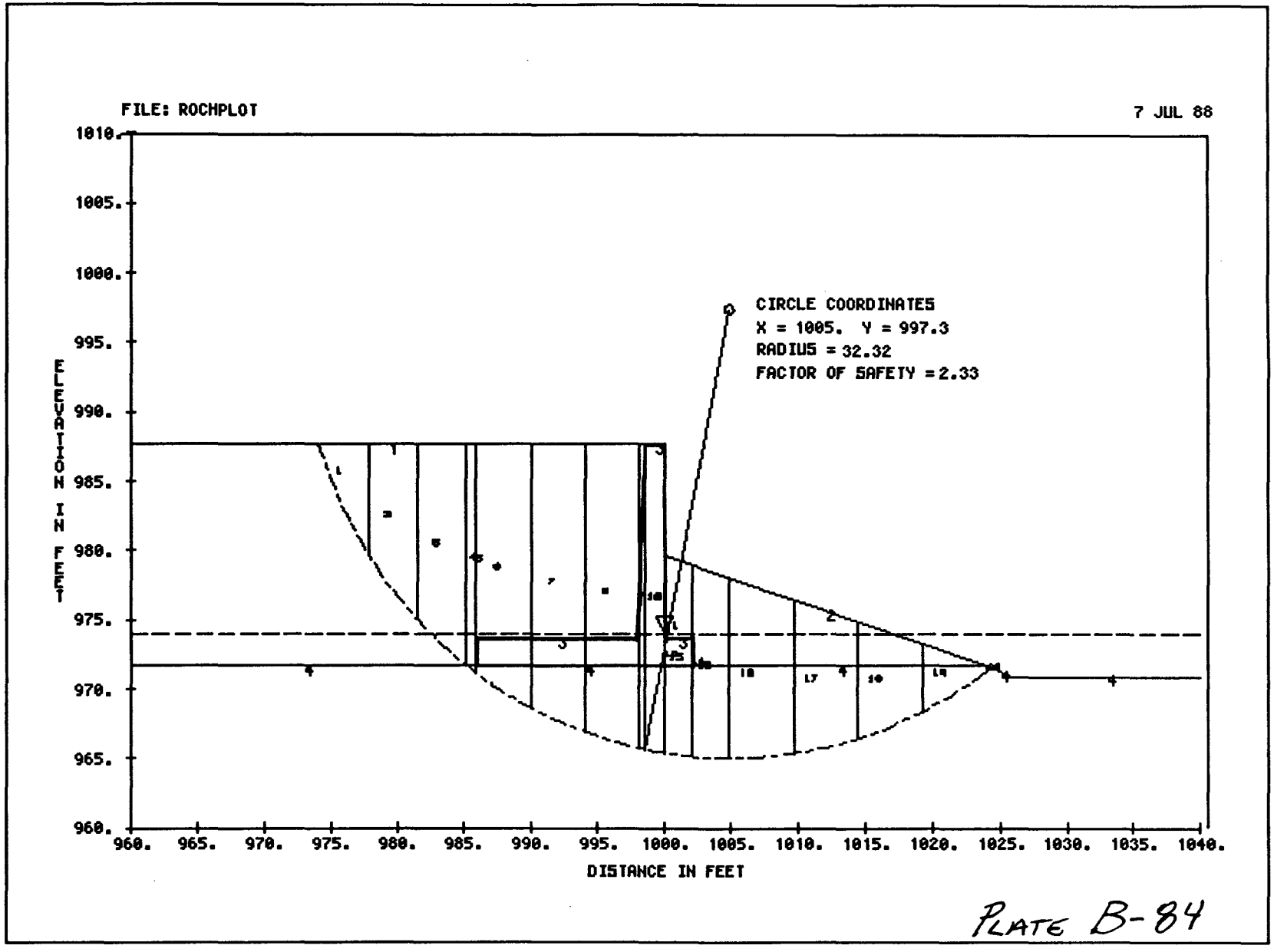

FILE: ROCHPLOT
7 JUL 88
CIRCLE COORDINATES
X = 1005. Y = 997.3
RADIUS = 32.32
FACTOR OF SAFETY = 2.33
ELEVATION IN FEET
1010.
1005.
1000.
995.
990.
985.
980.
975.
970.
965.
960.
960. 965. 970. 975. 980. 985. 990. 995. 1000. 1005. 1010. 1015. 1020. 1025. 1030. 1035. 1040.
DISTANCE IN FEET

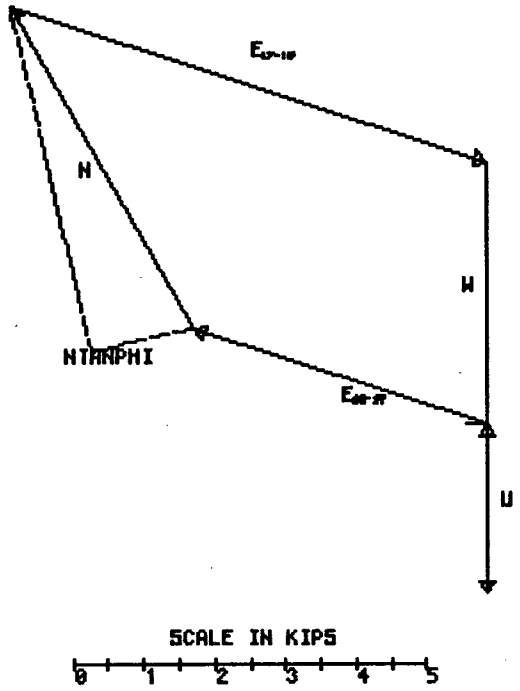
PLATE B-84

FORCE DIAGRAM

FILE: ROCHPLOT

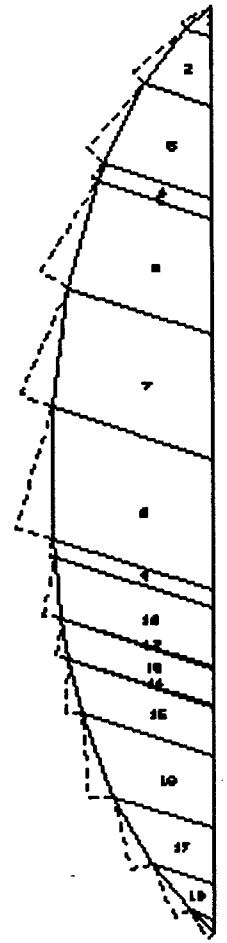
7 JUL 88

SLICE 17



SCALE IN KIPS

0 1 2 3 4 5



ERROR OF CLOSURE 0.

PLATE B-85

TABULATION OF SLICE DATA

FILE: ROCHPLOT 7 JUL 88

SLICE	SLICE WIDTH	SLICE COORD	SLICE WT	WATER FORCE	DIREC TION	DEVEL C-FORCE	DIREC TION	PHI DEVEL	NORM STRESS	NORM FORCE	ALPHA TOP	ALPHA BOT	E1	E2
1	3.73	975.9	2.08	0.	0.	0.	-63.73	14.99	.26	2.21	-18.52	-18.52	0.	1.81
2	3.73	979.6	4.7	0.	0.	0.	-51.39	14.99	.76	4.53	-18.52	-18.52	1.81	4.74
3	3.73	983.4	6.5	.18	90.	0.	-41.76	14.99	1.17	5.84	-18.52	-18.52	4.74	7.62
4	.76	985.6	1.51	.12	90.	0.	-36.63	16.12	1.33	1.27	-18.52	-18.52	7.62	8.1
5	.01	986.	.02	0.	90.	0.	-35.78	16.12	1.38	.02	-18.52	-18.52	8.1	8.11
6	4.	988.	8.98	1.06	90.	0.	-31.51	16.12	1.54	7.23	-18.52	-18.52	8.11	10.22
7	4.	992.	10.13	1.58	90.	0.	-23.51	16.12	1.82	7.94	-18.52	-18.52	10.22	11.34
8	4.	996.	10.92	1.93	90.	0.	-15.98	16.12	2.08	8.64	-18.52	-18.52	11.34	11.31
9	.5	998.2	1.51	.26	90.	0.	-11.87	16.12	2.41	1.23	-18.52	-18.52	11.31	11.21
10	1.49	999.2	4.84	.79	90.	0.	-10.08	16.12	2.68	4.06	-18.52	-18.52	11.21	10.74
11	.01	1000.	.03	.01	90.	0.	-8.73	16.12	2.13	.02	-18.52	-18.52	10.74	10.74
12	.01	1000.	.02	.01	90.	0.	-8.71	16.12	1.43	.01	-18.52	-18.52	10.74	10.74
13	1.99	1001.	3.71	1.09	90.	0.	-6.92	16.12	1.34	2.7	-18.52	-18.52	10.74	10.26
14	.01	1002.	.02	.01	90.	0.	-5.14	16.12	1.32	.01	-18.52	-18.52	10.26	10.26
15	2.89	1003.	5.07	1.62	90.	0.	-2.56	16.12	1.28	3.71	-18.52	-18.52	10.26	9.31
16	4.78	1007.	7.61	2.66	90.	0.	4.24	16.12	1.21	5.8	-18.52	-18.52	9.31	7.09
17	4.78	1012.	6.24	2.44	90.	0.	12.8	16.12	1.04	5.11	-18.52	-18.52	7.09	4.38
18	4.78	1017.	4.36	2.	90.	0.	21.68	16.12	.75	3.87	-18.52	-18.52	4.38	1.77
19	4.78	1022.	1.82	.84	90.	0.	31.14	16.12	.39	2.18	-18.52	-18.52	1.77	.02
20	.38	1024.	.01	.01	90.	0.	36.64	16.12	.04	.02	-18.52	-18.52	.02	0.

ALL FORCES IN KIPS
ALL ANGLES MEASURED FROM POSITIVE X-AXIS

PLATE B-86

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B SUPPLEMENT

APPENDIX C
STRUCTURAL ANALYSIS & DESIGN

FLOOD CONTROL
SOUTH FORK ZUMBRO RIVER
FEATURE DESIGN MEMORANDUM
ROCHESTER, MINNESOTA, STAGE 1-B
APPENDIX C

STRUCTURAL ANALYSIS & DESIGN
TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

APPENDIX C

STRUCTURAL ANALYSIS & DESIGN

PURPOSE

1. This appendix describes the methodology and assumptions used in the analysis and/or design of:

(a) Modifications to Silver Lake Dam

(b) Flood/Retaining Walls

(c) Bikeway Underpass Structures

REFERENCES

2. The applicable sections of the following references were used to formulate design criteria and to determine allowable stresses in the various structural components.

(a) EM 1110-1-2101 Working Stresses for Structural Design (November, 1963)

(b) EM 1110-2-2103 Details of Reinforcement-Hydraulic Structures (May, 1971)

(c) EM 1110-2-2906 Design of Pile Structures and Foundations (July, 1958)

(d) ETL 1110-2-256 Sliding Stability for Concrete Structures (June, 1981)

(e) EM 1110-2-2200 Gravity Dam Design (Sept., 1958)

(f) ETL 1110-2-275 Concrete Removal Methods (July, 1982)

(g) ETL 1110-3-338 Wind and Snow Loads (February, 1983)

(h) EM 1110-2-2702 Design of Spillway Tainter Gates (August, 1966)

(i) EM 1110-2-2002 Maintenance and Repair of Concrete and Concrete Structures (March, 1979)

(j) EM 1110-2-2000 Standard Practices for Concrete (Sept., 1982)

(k) EM 1110-2-XXXX Retaining and Flood Walls (June 14, 1985)

(l) EM 1110-2-1612 Ice Engineering (Oct., 1982)

(m) Condition Survey, Silver Lake Dam, Rochester,

MN. Barrientos & Assoc., Inc. (Jan. 1985)

(n) Specifications for Dam Repair - Silver Lake Dam, Harza Engineering Co., (May, 1982)

(o) Construction Summary Report - Silver Lake Dam Repair, Harza Engineering Co., (Nov. 1981)

(p) Specifications for Dam Repair - Silver Lake Dam, Harza Engineering Co., (July, 1981)

(q) Repairs to Silver Lake Dam, Harza Eng. Co., (January, 1952)

(r) Stell Construction Manual (AISC 8th Edition)

(s) Building Code Requirements for Reinforced Concrete (ACI 318-83)

(t) American Association of State Highway and Transportation Officials Standard Specifications for Highway Bridges 1983, as Amended by 1984 and 1985 Interim Specifications.

DESIGN CRITERIA

REINFORCED CONCRETE STRUCTURES

3. The modifications and additions to the concrete elements of the existing Silver Lake Dam were designed in accordance with Working Stress Design (WSD). A concrete compressive stress (f'c) of 3000 pounds per square inch (psi) was used in the design of the alterations. Actual compressive concrete fiber stress was held to 1050 psi as per hydraulic structures requirements. Maximum reinforcing steel stress was limited to 20,000 psi in deformed billet steel bars of Grade 40 or better.

4. The reinforced concrete flood/retaining walls, abutment wing wall extensions, bikeway retaining walls and bridges were designed in accordance with the principles of Load Factor Design. Ultimate concrete compressive strength (f'c) of 4000 psi was used for design. Maximum reinforcing steel stress was limited to 48,000 psi in deformed billet steel bars of Grade 40 or better.

STRUCTURAL STEEL

5. The modifications to the existing tainter gates and the new Pier No. 3 access bridge were designed in accordance with EM 1110-1-2101 using a basic working stress 18,000 psi. Structural steel shall conform to ASTM A36.

STEEL SHEET PILING

6. Steel sheet piling shall conform to the requirements of ASTM A328. The maximum allowable stress shall be 23,500 psi.

ALUMINUM

7. Aluminum required for miscellaneous elements shall be 6061-T6. Working stresses used in the designs will be in accordance with EM-1110-1-2101.

TREATED TIMBER PILING

8. Where new piling was added, such piling was designed for a maximum loading of 20 tons per pile. The timber piles and treatment shall conform to Guide Specification CW-02311.

STEEL H PILING

9. Bike path bridge abutment piling were designed for a maximum loading of 40 tons per pile. The steel H piling shall conform to Guide Specification CW-02315.

STRUCTURAL TIMBER

10. The timber used in the roofs of the mechanical rooms at Silver Lake Dam shall be Douglas Fir Dense No. 1 grade or better per the Western Wood Products Association.

UNIT WEIGHTS

11. The unit weights used in design were assumed as follows:

Concrete	150	P.C.F.
Steel	490	P.C.F.
Water	62.4	P.C.F.
Earth (Silver Lake Dam)	120	P.C.F.
Earth (Dry) Flood Walls	125	P.C.F.
Earth (Sub.) Flood Walls	65	P.C.F.
Timber	40	P.C.F.
Soil (Immersed)	80	P.C.F.

ICE LOADING

12. The ice loading used in the structural design of Silver Lake Dam modification was assumed 1000 pounds per linear foot of loaded structure applied at the critical horizontal ice plane. The ice loading for the pedestrian pier design was in accordance with the current AASHTO Standard Specifications for Highway Bridges Section 3.18.

DEPTH OF COVER

13. Any additions to the existing foundations at Silver Lake Dam were set at the depth of such foundations. Thererfore, it is expected that frost cover will be satisfactory. Footings for retaining walls shall be founded on sound rock capable of resisting the design loads or on soil with a minimum frost cover 5' 0".

DESIGN OF STRUCTURES

GENERAL

14. The modifications to be made to Silver Lake Dam were of superficial structural nature only, so far as the total dam was concerned. The added dead loads and live loads from the equipment houses were relatively small, the raise of head of water on the dam was nominal, and the change to a hinged leaf gate of local effects only. Thus, the major design effort there became the proving of the existing structure as satisfactory and/or correcting its deficiencies.

15. The bikeway underpass at the east abutment of the Center Street Bridge was designed in detail. Appropriate items therefrom were used to estimate the quantities for bikeway underpasses at Seventh Street and Third Avenue.

SILVER LAKE DAM

OGEE - STILLING BASIN

16. The existing ogee - stilling basin was analyzed as it would function with the concrete ogee cut away to seat the new hinged leaf gate. The analysis was performed using dead load; full water pressure, uplift, and silt (earth) pressures; and ice load applied at the top of the gate. It was found that the ogee - stilling basin was stable against overturning in that its piling were not overloaded in vertical loading. However. the piles could not resist the sliding forces in direct shear.

17. To remedy this, forces were introduced into the ogee - stilling basin through the use of soil anchors. Such forces were set to act opposite to those of the sliding forces. With 30 ton soil anchors working at 7' 0" spacing, the structure proves satisfactory in both stability and sliding.

18. An upstream widening of the ogee - stilling basin was required to fit the hinged-leaf gate's upstream shape to the new ogee's downstream curve. The details of the widening are shown on the structural plates. The concrete-wall type widening was designed to take the horizontal and vertical reactions of the gate as brought about by bearings acting at 15 foot centers.

EQUIPMENT HOUSE AT RIGHT ABUTMENT

19. To provide for a house large enough to suit the equipment, it was necessary to locate the house limits seven feet upstream from the existing abutment face. This modification was made in mass concrete founded on a new pile-supported footing. It was felt that this construction would prove most economical in long-term maintenance.

20. An analysis was run of the modified structure as founded on its pile pattern. The analysis showed the existing abutment piles to be significantly overloaded in vertical loads. Over thirteen additional piles would be necessary to make the abutment figure theoretically adequate yet the existing abutment had stood for 50 years with nearly the same loading and shows no distress.

21. A second analysis was run of the modified structure as though founded on supporting soils. The maximum soils pressures developed under the governing loading was 3.5 kips per square foot. Soils Exploration, Inc. has analyzed the supporting soils as capable of taking this load with a safety factor of seven. This probably means that the existing overstressed piles must be yielding slightly allowing the more than adequate soils below to come into bearing.

22. The floor of the house was designed to transfer a 140 kip trunnion loading, yielding components of 125 kips vertically and 65 kips horizontally, into the foundations below.

MODIFICATIONS AT LEFT ABUTMENT

23. Assuming the yielding of the foundation piles in the left abutment under design loads, the soils below come into bearing and successfully support the structure. Thus, no modifications prove necessary at the left abutment other than those minor constructions to seat the new access bridge running to Pier No. 3.

MODIFICATION TO TAINTER GATE PIERS NO. 1 AND NO. 2

24. An analysis of the tainter gate piers under the existing loads show them to be in danger of sliding if dependent on the shearing resistance of their piles alone.

25. To remedy this, forces were introduced into the tainter gate bays through the use of soil anchors. Such forces were set to act opposite to those of the sliding forces. With 25 ton soil anchors working at 7' 0" spacing, the structure proves satisfactory in both stability and sliding. Additional minor construction is required to seat the new access bridge.

EQUIPMENT HOUSE AT TAINTER GATE PIER NO. 3

26. As per the right abutment, the tainter gate Pier No. 3 was made large enough to suit equipment needs by widening and extending the pier mass upstream. New pile supported footings were provided for the

widening and lengthening.

27. An analysis was run of the modified structure as founded on its new pile pattern. The analysis indicated the structure was satisfactory in the vertical loadings of the piling but deficient in its resistance to sliding through shear in the piles.

28. As per Pier No. 1 and No. 2, 25 ton soil anchors working at 7' 0" spacing were used to introduce forces opposite to the sliding forces. The analysis then proved satisfactory.

STRENGTHENING OF TAINTER GATES

29. The existing tainter gates were analyzed assuming the use of ASTM A-7 steel stresses of 16,500 psi (with 33% overstress of 22,000 psi when in combination with ice). The make up of the gates was taken from the Condition Survey as prepared by Barrientos & Associates, Inc.

30. The gate was analyzed in two "down" positions for maximum water load plus ice. The initial position was with the gate's lower edge resting on its seal. The second position was with the gate lifted by its chains to raise its lower edge just off of the seal. The gate frame was run on the computer as fully continuous as per welded joint theory.

31. The check of all existing members in the gate frame under governing stress indicated on overstress in the most upstream vertical 6" x 4" x 3/8" angle. A method of strengthening the angle was developed and appears on the structural drawings. This member was the only part of the gate deficient in strength.

NEW ACCESS BRIDGE

32. A new access bridge was designed to serve the new equipment house at tainter gate Pier No. 3. The bridge was repositioned from its original location so that the tainter gate underneath could be opened fully without fouling the structure. The bridge was designed for 100 psf uniform pedestrian live load plus concentrated loads at fixed locations brought on to the bridge by the tainter gate's lifting chains.

33. The bridge was designed in structural steel per ASTM A36. It was felt that steel would be the most suitable median for erection over the operating tainter bays. A galvanized bar grating deck was designed with the intent that the final grating closures be placed in the deck after the final positioning of the chain hoists to suit the travel of the lifting chains.

NEW UPSTREAM APRON AND CONCRETE REPAIRS.

34. The new upstream apron's width was set by the seepage analysis as run by Soils Exploration, Inc., the soils consultant to the project. The apron's design was based on empirical standards successfully in

use.

35. The concrete repairs as illustrated in the structural plates, may not be all of those needed. After the dewatering of the structure is accomplished, a thorough inspection of the structure in the dry should be made. Such additional repairs as prove necessary should be performed on a "force-account" basis.

PRESSURE GROUTING

36. The dam has had some pressure grouting of its foundation done in past years.

37. In 1952, a recommendation was made by Harza Engineering Company to grout under the entire length of ogee section. Apparently this was not done entirely. Borings taken by Barrientos & Associates, Inc. during their Condition Survey of January, 1985, found no grout to the right of the mid-length of ogee.

38. In 1981, while repairing the dam, an undermining of the tainter gate area was discovered. Repairs were made, in a contract of May, 1982, by the driving of sheet piling about the upstream face of the tainter gate apron, and by the pressure grouting of major voids under the entire gated portion.

39. Barrientos' Condition Survey of January, 1985, indicates an apparent void under the ogee portion of the structure approximately 10 foot to the right of the tainter gate Pier No. 3. However, it would appear that there is no significant seepage through this void.

40. No pressure grouting of the void or voids is felt necessary as part of the recommended modifications. The new seepage control as shown on the structural plates should prove very effective.

CONCRETE REMOVAL METHODS

41. Those cuts of concrete section requiring straight line exposed edges shall have such edges cut to a depth of one inch minimum with a diamond saw or approved substitute, prior to use of breaker equipment for deeper removal.

42. Explosive blasting will be permitted for the removal of the mass ogee concrete, but only after satisfying all permit requirements as required by the City of Rochester. A fully developed blasting plan shall be presented to the Corps of Engineers and other interested authorities at least 10 days in advance of such blasting. Such plan shall list methods of blasting; experience of personnel performing blasting; safety precautions that will be used in protecting life, property, and the environment; methods of explosive storage; and anticipated time and dates of blasting. The Contractor shall make arrangements of the control of vehicular and pedestrian traffic as might be necessary at the time of blasting.

43. In lieu of explosive blasting, a vehicle mounted breaker may be used to remove the mass concrete of the ogee, but the energy output shall be monitored to preclude damage to the remaining concrete.

FLOOD/RETAINING WALLS

LOCATIONS

44. The concrete flood/retaining wall is located on the right bank from stations 125+73 to 126+58 and on the left bank from stations 126+23 to 126+50. This is between the Silver Lake Dam and the North Broadway bridge.

DESIGN LOADS

45. Soil parameters used were determined from lab tests of soil samples near the walls. The saturated unit weight of soil used was 125 p.c.f., internal friction angle equal to 35^{o}, and wall friction equal to 12^{o}. The critical design case these walls were designed for was saturated soil behind the walls to El. 978.88 with a sloping backfill. Sliding was computed using a strength reduction factor (SRF) of 2/3 to withstand the horizontal forces. A load factor of 1.9 was applied to the live and dead load. The maximum bearing pressure on the wall foundation was 3.0 k.s.f.

SEVENTH STREET BRIDGE WINGWALL EXTENSIONS

46. Cantilever sheet pile wing wall extensions with a concrete cap are required on both abutments of the Seventh Street bridge. The top elevation of the wing walls is approximately elevation 981.1 plus or minus, and varies in length from 27 to 35 feet. A level backfill extended 1/3 of the embankment slope of 30^{o}. An adjusted internal friction angle $\emptyset$ adj) with a safety factor of 1.5 and a wall friction angle of 8^{o}. (1/4$\emptyset$ adj /3) used to determine piling length. The design reference was the USS Steel Sheet Piling Design Manual with the above exceptions.

LOCATION

47. The flood/retaining walls are located at the following areas:

Sta. 165+15 to 169+05 Right Bank
Sta. 169+40 to 174+79 Right Bank
Sta. 177+50 to 183+67 Right Bank
Sta. 186+20 to 202+90 Left Bank
Sta. 187+45 to 193+45 Right Bank

The front face of the walls in certain areas will be textured in some manner to be selected later by the City of Rochester.

DESIGN LOADS

48. Three cases of loading were considered as follows:

Case I: Dead load plus dry backfill at 55 pounds equivalent fluid pressure (EFP) plus live load surcharge where appropriate.

Case II: Dead load plus submerged backfill at 98 pounds EFP.

Case III: Dead load plus a 30 PSF wind on the front face of wall. This loading primarily used to assure that front face reinforcing is adequate to withstand wind loads prior o placement of backfill.

49. Where walls can be supported on rock the upper two feet was assumed to be unsuitable for the design loads. The backfill was assumed cohesionless and fully submerged up to design high water elevation. A live load surcharge was applied to the walls where appropriate. Sliding was computed (SRF = 2/3) and a key was designed in the rock to withstand the excess horizontal forces. Maximum allowable bearing pressure on sound rock was assumed to be five tons per square foot. Maximum design bearing pressure was 3.1 tons per sq. ft. with no uplift permitted at the heel for any load combination. For the design of steel reinforcing a load factor of 1.9 was applied to dead load plus live load.

50. Where walls must be supported on soil the design loads were the same as for rock foundations. Allowable bearing pressures and sliding were computed using appropriate criteria and no uplift was permitted at the heel for any load combination.

LOCATION

51. The sheet pile flood wall with a concrete cap is located on the left bank from stations 172+37 to 182+60 and from stations 184+75 to 186+25.

DESIGN LOADS

52. Soil parameters used were determined from lab tests of soil samples near the wall. The design reference used for this anchor-sheet pile wall was the USS Steel Sheet Piling Design Manual with the following exceptions. An adjusted internal friction angle (ϕ adj) with a safety factor of 1.5 was used in the determination of the piling length, but not to the piling section modulus sizing. A level backfill to the top of the wall was assumed with a wall friction angle of 8^{o} (1/4 ϕ adj /3). The saturated unit weight of soil used was 125 p.c.f. A 2" diameter tie-rod of A36 steel was used with a 9' and 12' spacing. A continuous concrete anchor deadman was used in the region of full mobilization. The wales are A36 structural steel channels.

LOCATION AND CONDITION COMMENTS

53. The existing flood wall on the left bank from approximately Sta.

202+90 to Sta. 205 was analyzed using EFP of 98 PCF and current C.O.E. design criteria. At upstream end of wall where fill is to top of wall the reinforcing steel is overstressed and resistance to lateral forces is inadequate. At the downstream end of the wall the fill is about four feet below the top of wall however, horizontal pile shears are excessive.

54. If the stream bed is lowered as planned it is likely that the lateral deflections will increase and the piles will become overstressed in bending as well as shear.

CENTER STREET BIKEWAY UNDERPASS

EXISTING EAST ABUTMENT MODIFICATIONS

55. The elevation of the bottom of the proposed new channel is approximately four feet lower than the bottom of footing of the east abutment of the Center Street Bridge. Since scour protection is required for this footing it was economical to combine the design of he bikeway with the scour protection in front of the, abutment.

56. Using a strength reduction factor (SRF) of 2/3 the abutment was checked for sliding under dead load plus submerged earth to the elevation to design high water plus live load surcharge. Drilled-in rock anchors were designed to withstand the residual horizontal forces not counteracted by friction.

BIKEWAY BRIDGES

57. Since the design live load for a bikeway is 85 PSF it is possible to construct short span concrete slab bridges in some areas more economically than retaining walls. The piers and abutments should be constructed first and the rock fill on the upstream side and riprap on the downstream side placed prior to constructing the concrete slab spans.

58. The concrete slab spans are not considered to be hydraulic structures and load factors used were in accordance with ACI (1.4 DL + 1.7 LL) for design of the steel reinforcing.

59. The piers were designed with a safety factor of 1.6 against overturning with a 50 PSF wind without any superstructure dead load or backfill on the footing. Thermal forces were included in the design but wind forces on the completed structure were found to be insignificant.

ABUTMENT WINGWALL EXTENSIONS

60. The abutment wingwall extensions are to be constructed on rock except for the 68 foot section at the downstream end of the downstream extension which will be founded on soil. These walls were designed for dead load plus submerged backfill without any live load surcharge. Sliding was computed and a key designed to resist all excess horizontal

forces. A load factor of 1.9 was used for steel reinforcing design. EFP for submerged backfill was 96 PCF. Walls less than fifteen feet in height shall be 1'-0" thick at the top and higher walls shall be 1'-6" thick at the top. Back face batter for all walls is 3/4" per foot. These walls will be isolated from the bikeway bridge and pavement slabs with expansion joint material. A steel pedestrian railing similar to that existing will be required on top of the wing wall extensions.

PEDESTRIAN BRIDGE - STA. 194+00

LOCATION

61. The pedestrian bridge will span the Zumbro River at the east side of the Rochester Civic Center and will provide access for pedestrians and bikers and from the right bank bikeway path and river access.

SUPERSTRUCTURE

62. The pedestrian bridge superstructure is proposed to be a proprietary design for a three span steel truss bridge without top lateral bracing. Design live load shall be 85 PSF in accordance with current AASHTO Standard Specifications for Highway Bridges. Structural steel shall be ASTM A588 material which oxidizes to a dark brown color and does not require painting. Deck shall be two inch timber planks. The superstructure shall clear design high water by 3.0' at the piers.

ABUTMENTS

63. The west end span shall rest on the top of the floodwall on the left bank. The east end span will rest on a reinforced concrete abutment in the right bank slope supported by steel H piling.

PIERS

64. The two river piers are designed for dead load, live load, wind, stream flow, buoyancy and ice. Maximum design pile bearing is 30 tons per pile. The ice loading is applied midway between high and low water elevation.

RIVER ACCESSES

LOCATION

65. Access to the river is provided at the following locations:

Sta. 156+40 Left Bank
Sta. 160+30 Left Bank
Sta. 176+00 Left Bank
Sta. 195+20 Right Bank
Sta. 196+00 Left Bank

DESCRIPTION

66. The access at Sta. 156+40 R is a boat ramp composed of reinforced concrete plank anchored to the slope by deadmen. The accesses of Sta. 160+30 L and Sta. 195+20 R are designed as reinforced concrete steps with curtain walls and interior support walls below frost line.

67. The access at Sta. 176+00 L is composed of reinforced concrete steps and platform with steel sheet piles retaining the earth and a textured concrete veneer on the exposed surface of the sheets. The access at Sta. 196+00 L is composed of reinforced concrete floodwalls retaining the earth from the steps and platform. Exposed surfaces of the walls shall be textured.

SHELTER

DESCRIPTION

68. The Shelter at Sta. 195+25 right bank will be similar in design to the Shelter in Stage 1A-2B at Sta. 97+23.50 right.

#135
fczumbro.dt

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B

STRUCTURAL COMPUTATIONS
SUPPLEMENT TO STAGE 1B

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B

COMPUTATIONS FOR FLOOD WALLS - RT. BANK
STA. 165+15 TO 169+05
STA. 177+50 TO 183+67

4283.5 _ STAGE 1B	RETAINING WALLS ZUMBRO RIVER	FKC	2/1/88

BORING NUMBER	STATION NUMBER	BORING DIST FROM BIKE PATH	FOOTING ELEV.	MATERIAL ABOVE FOOTING	MATERIAL BELOW FOOTING
84-82M	168+80	45'	977.87	POORLY GRADED SAND	POORLY GRADED SAND
86-95M	177+77	68'	982.33		
84-86M	178+45	7'	980.64	SAND SILTY GRAVEL GRAVEL SAND SILT	ROCK
86-94M	179+00	30'	980.68	(FILL)	(FILL)
85-91M	180+71	55'	980.82	SILTY SAND	SILTY SAND
83-57M	182+13	30'	980.93	SILTY GRAVEL GRAVEL SAND	ROCK
86-93M	182+45	95'	980.96	(FILL)	(FILL)

ALL THOSE BORINGS ARE BETWEEN THE FOLLOWING STATIONS:

165+10 ⟶ 169+10

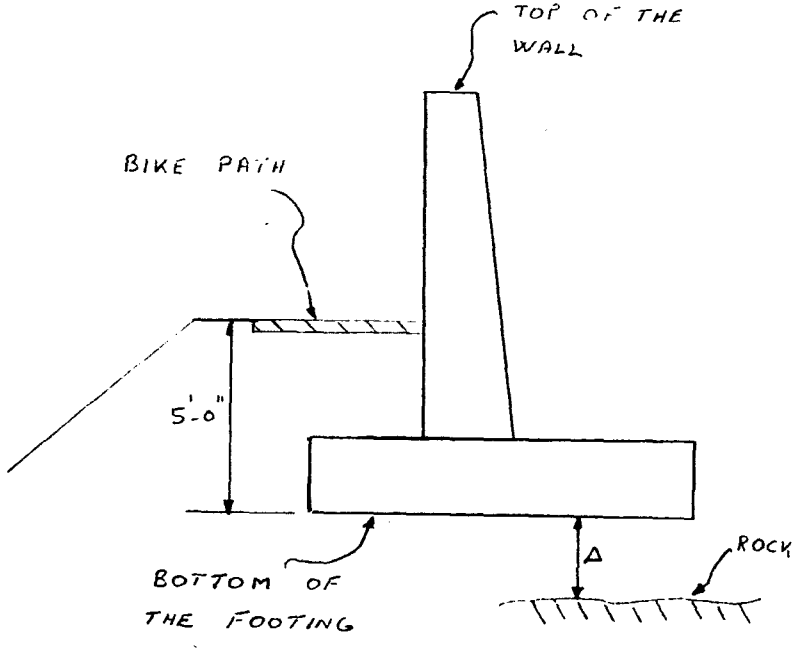
177+30 ⟶ 183+50

BORING NO : 83-52M
STA : 172+09

ELEV.	MATERIAL
984.5	SILTY SAND
979.0	
979.0	POORLY SAND
978.5	
978.5	SILTY SAND
978.0	
978.0	SILTY GRAVEL
977.5	

IT WILL BE ASSUMED THAT ALL THE FOOTINGS IN THE REGION BETWEEN 165+10 AND 169+10 WILL BE SITTING ON SAND.

* DESIGN FOR WALL HEIGHTS OF 6', 9' & 12'-6"



STATION NUMBER	165+10	165+65	166+00	166+50	167+00	167+50	168+00	168+50	169+00	169+10
ELEV. OF TOP OF THE WALL	985.00	985.03	985.04	985.07	985.09	985.12	985.15	985.17	985.20	985.20
ELEV. OF BOT. OF THE FOOT.	979.50	975.0	973.00	973.00	973.00	973.00	973.00	976.05	979.09	979.70
HEIGHT OF THE WALL (FT)	5.50	10.03	12.04	12.07	12.09	12.12	12.15	9.12	6.11	5.50
ELEV. OF BED ROCK	BELOW 965.00	BELOW 965.00	BELOW 965.00	BELOW 965.00	BELOW 965.00	BELOW 965.00	BELOW 965.00	BELOW 965.00	966.20	966.20
Δ (FT)	> 14.50	> 10.00	> 8.00	> 8.00	> 8.00	> 8.00	> 8.00	> 11.05	12.89	13.50

STATION NUMBER	177+30	178+00	178+50	179+00	179+50	180+00	180+30	181+00	182+00	182+55
ELEV. OF TOP OF THE WALL	990.98	991.04	991.08	991.12	991.84	992.57	993.00	993.06	993.15	993.20
ELEV. OF BOT. OF THE FOOT.	985.98	980.60	980.64	980.68	980.72	980.76	980.78	980.84	980.92	980.96
HEIGHT OF THE WALL (FT)	0.0	10.44	10.44	10.44	11.12	11.81	12.22	12.22	12.23	12.24
ELEV. OF BEDROCK	979.40	977.60	980.00	978.44	978.33	978.75	980.00	980.70	980.90	983.50
Δ (FT)	6.58	3.00	0.64	2.24	2.39	2.01	0.78	0.14	0.02	-2.54

STATION NUMBER	183+00	183+50
ELEV. OF TOP OF THE WALL	996.18	999.50
ELEV. OF BOT. OF THE FOOT.	981.00	981.00
HEIGHT OF THE WALL (FT)	15.18	18.50
ELEV. OF BEDROCK	985.60	985.60
Δ (FT)	-4.60	-4.60

C-17

4283.5 – STAGE 1B

RETAINING WALLS
ZUMBRO RIVER

FKO

7/1/32

ROCHESTER – ZUMBRO RIVER – PHASE B
JOB NO. 4283.5 – 18

Wallace Holland Kastler Schmitz & Company
Consulting Engineers & Planners
Mason City, Iowa & Rochester, Minnesota

SHEET 1 OF
MADE FKD DATE 3/8/88
CHECKED CEW DATE 3-21-88

CALCULATIONS FOR FLOOD WALLS

DESIGN CRITERIA

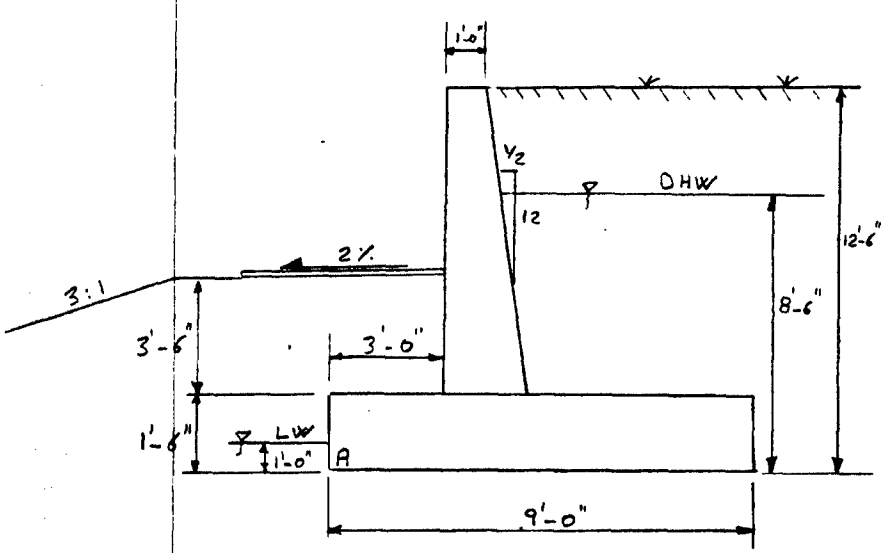
SOIL PARAMETERS FROM PAGE B-25

BACKFILL : $\phi = 32^\circ$
$\gamma = 120$ PCF
$\gamma_s = 130$ PCF

INSITU : $\phi = 34^\circ$

STA 166+00 ⟶ 168+00

HEIGHT OF THE WALL : 12'-6"



FROM EM 1110-2-XXXX p. 3-7

SRF = 2/3

$\phi_d = \tan^{-1}\left[(0.667)(0.625)\right] = 22.62^\circ$

$K_A = \dfrac{1-0.385}{1+0.385} = 0.444$

ASSUME 25% VOIDS IN THE SOIL

$\gamma_{SUB} = 120 - (0.75)(62.4) = 73.2$

$P_{DRY} = \frac{1}{2} K_A \gamma H^2 = \frac{1}{2}(0.44)(120) H^2$

$= \frac{1}{2}(53.3) H^2$

$P_{SUB} = \frac{1}{2}(0.44)(73.2) H^2$

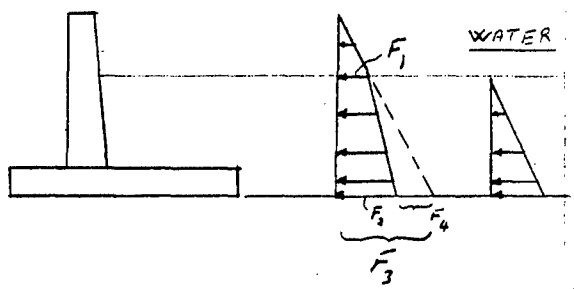
$= \frac{1}{2}(32.2) H^2$

USE GEG #10 FOR DESIGN

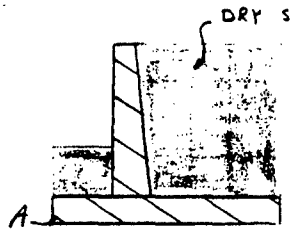
THE LAW OF SUPERPOSITION IS USED TO GET THE TOTAL HEEL AND TOE PRESSURE.

THIS DIAGRAM REPRESENTS THE LATERAL FORCES ACTING ON THE WALL.

EARTH



INPUT ①



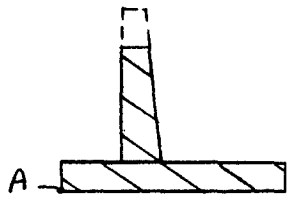
H = 12.5' SW = 130
B = 9.0 E = 53.
W = 1.0' S = 0
T = 1.5' P = 10

A = 3.0 C = 3.5' F = 0.5

$P_{HEEL} = 707.62$ PSF

$P_{TOE} = 2014.70$ PSF

INPUT ②



H = 8.5' SW = 0
B = 9.0 E = 0
W = 1.167 S = 0
T = 1.5 P = 0

A = 3.0 C = 0 F = 0.5

THE PRESSURE DUE TO BUOYANCY IS PRORATED BASED ON PRESSURE DUE TO CONCRETE. (62.4/150)

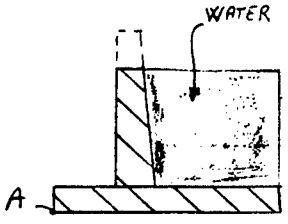
CALCULATIONS FOR FLOOD WALLS

BUOY.

P_{HEEL} = 292.3 PSF − 121.6 PSF

P_{TOE} = 464.04 PSF − 193.0 PSF

INPUT ③



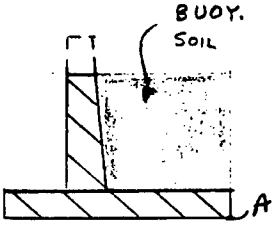
H = 8.5' SW = 0
B = 9.0 E = 62.4
W = 1.167 S = 0
T = 1.5 P = 0

A = 3.0 C = 0 F = 0.5

P_{HEEL} = −180.80 PSF

P_{TOE} = 937.13 PSF

INPUT ④



H = 8.5 SW = 0
B = 9.0 E = 21.10
W = 1.167 S = 0
T = 1.5 P = 0

A = 4.54 C = 0 F = 0.5

P_{HEEL} = 466.75 PSF

P_{TOE} = 289.57 PSF

$F_1 = (53.3)(4) = 213.2$

$F_2 = (32.2)(8.5) + 213.2 = 486.9$

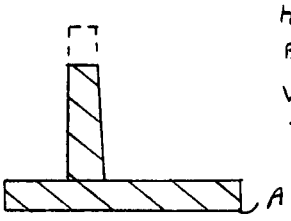
$F_3 = (53.3)(12.5) = 666.25$

$F_4 = 666.25 - 486.9 = 179.35$

$E(8.5') = 179.35$

$E = 21.10$

INPUT ⑤



H = 8.5' SW = 0
B = 9.0 E = 0
W = 1.167 S = 0
T = 1.5 P = 0

A = 4.54 C = 0 F = 0.5

P_{HEEL} = 306.90 PSF

P_{TOE} = 449.50 PSF

TOTAL P_{HEEL} = 707.62 − 292.30 − 180.80 + 467 − 306.90 − 121.6
= 273.02 PSF

TOTAL P_{TOE} = 2014.70 − 464.03 + 937.13 + 290.0 − 449.50 − 193
= 2135.3 PSF

BEARING PRESSURE ANALYSIS (p. 5-1)

$\phi = 34°$ $c = 0$

$N_q = 29.44$ $N_\gamma = 31.15$

$$\epsilon_{qd} = \epsilon_{\gamma d} = 1 + 0.1\left(\frac{D}{B}\right)\tan\left(45 + \frac{\phi}{2}\right)$$

$$= 1 + 0.1\left(\frac{5}{9}\right)(1.881) = 1.10$$

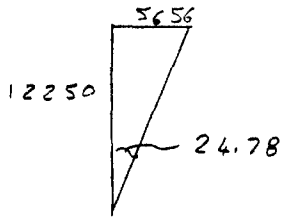
USE GEG PROG. #10

INPUT	ΣH	ΣV	ΣM_A
1	4164	12250	46304
2	0	3403	14156
3	2254	3403	7770
4	762	3403	2159
5	0	3403	0

CALCULATIONS FOR FLOOD WALLS

$\Sigma V = 12250 - 3403 + 3403 + 3403 - 3403$
$= 12250$

$\Sigma H = 4164 + 2254 - 762$
$= 5656$



$\Sigma M_A = 46304 + 2254(2.833) - 762(2.833)$
$= 50530$

$R = \frac{50530}{12250} = 4.13$

$e = 4.5 - 4.13 = 0.37$

$B' = 9 - 2(0.37) = 8.25$

$\epsilon_{qi} = \left(1 - \frac{\delta}{90}\right)^2 = \left(1 - \frac{24.78}{90}\right)^2 = 0.525$

$\epsilon_{\gamma i} = \left(1 - \frac{\delta}{\phi}\right)^2 = \left(1 - \frac{24.78}{34}\right)^2 = 0.074$

BASE TILT FACTOR = 1.0

$\epsilon_{\gamma g} = \epsilon_{qg} = [1 - \tan\beta]^2 = 1.0$

$q_0 = \gamma D \cos[ABS(\beta)]$

$q_0 = (0.120)(5) = 0.60$

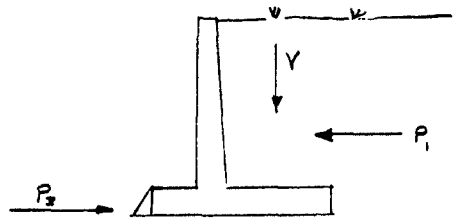
$Q = (8.26)[(1.10)(0.525)(1)(1)(0.60)(29.44) + (0.5)(1.10)(0.074)(1)(1)(8.26)(0.073)(31.15)]$

$= 90.6$

$F.S = \frac{90.6}{12.25} = 7.40$ O.K

C-20

SLIDING CRITERIA (APPENDIX - p. 4)



$P_3 = \left[\frac{(0.135)(1.5)^2}{2}\right]\left(\frac{1}{0.42}\right) = 0.345$

$SRF = \frac{P_1 - P_3}{\Sigma V \tan\phi} = \frac{5656 - 345}{12250(0.675)}$
$= 0.643 \Rightarrow F.S = 1.556$

SLIDING IS ADEQUATE

MIN "d" (p. 9-5)

$d_{min} = \left[\frac{M_u/\phi}{0.85 f'_c K_m b\left(1 - \frac{K_m}{2}\right)}\right]^{1/2}$

$K_m = \frac{f_y e_{max}}{0.85 f'_c}$, $e_{max} = \lambda e_b$

$e_b = \frac{(.85)(4)(0.85)}{48} * \frac{87}{87 + 48}$
$= 0.039$

$K_m = \frac{(48)(0.039)(0.25)}{0.85(4)} = 0.137$

$M_u = (1.9)(14.184) = 26.95$

$d_{min} = \left[\frac{(26.95)(12)/0.9}{0.85(4)(0.137)(12)\left(1 - \frac{0.137}{2}\right)}\right]^{1/2}$

$= 8.31''$
$0.5''$ ½ BAR
$2''$ CL.
$1.5''$
12.3

$d_a = 12'' + 5.5 = 17.5''$ O.K

ROCHESTER – ZUMBRO RIVER – PHASE 8
JOB NO. 4253.5-18

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SHEET 4 OF
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CALCULATIONS FOR FLOOD WALLS

$\frac{M_u}{bd^2} = \frac{26.50}{(13.5)^2} = 147.87$

$\rho = 0.00 < .75$

$A_s = 0.44 \text{ in}^2/\text{ft}$

#6 @ 1'-0"
or #5 @ 8"

SRF = 2/3

$\phi_d = 22.62°$

$\gamma_{SUB} = 73.2 \text{ PCF}$

$P_{DRY} = 1/2\ (53.3)\ H^2$

$P_{SUB} = 1/2\ (32.2)\ H^2$

USE GEG #10 FOR WALL DESIGN

THE LAW OF SUPERPOSITION IS USED TO GET THE TOTAL HEEL AND TOE PRESSURE.

DESIGN CRITERIA

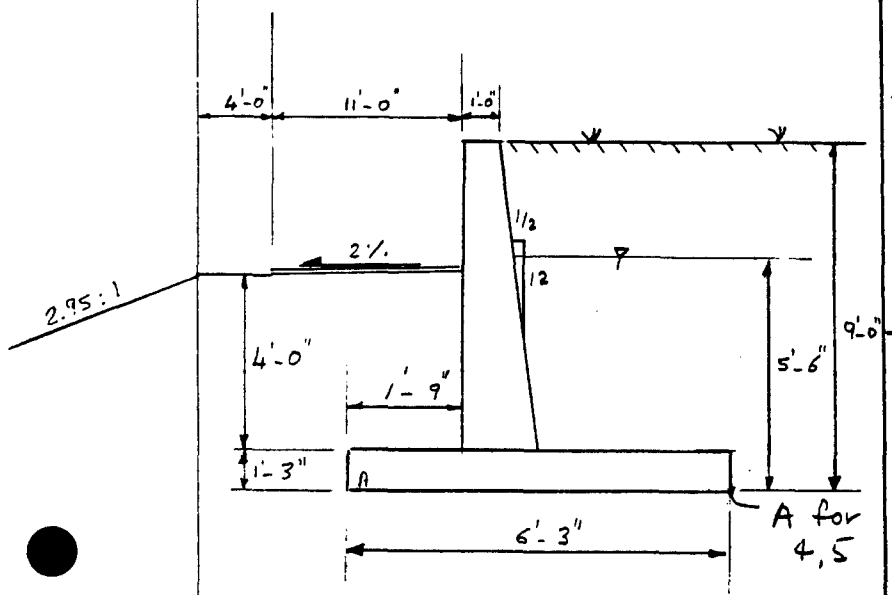
SOIL PARAMETERS FROM PAGE B-25

BACKFILL : $\phi = 32°$
$\gamma = 120 \text{ PCF}$
$\gamma_s = 130 \text{ PCF}$

INSITU : $\phi = 34°$

STA 168+50

HEIGHT OF THE WALL 9'-0"



INPUT	1	2	3	4	5	EJO
H	9.0	5.5	5.5	5.5	5.5	
B	6.25	6.25	6.25	6.25	6.25	
W	1.0	1.146	1.146	1.146	1.146	
T	1.25	1.25	1.25	1.25	1.25	
SW	130	0	0	0	0	
E	53.3	0	62.4	21.10	0	
S	0	0	0	0	0	
P	10	0	0	0	0	
A	1.75	1.75	1.75	3.167	3.167	
C	4.0	0	0	0	0	
F	0.5	0.5	0.5	0.5	0.5	
P_{HEEL}	365	222	-44	323	234	-92
P_{TOE}	1812	404	673	303	393	-168
ΣH	2159	0	944	319	0	
ΣV	6806	1959	1959	1959	1959	
ΣM_A	16560	5526	3796	6056	6621	

TOTAL P_{HEEL} = 365 – 222 – 44 + 323 – 234 – 92
= 96 PSF

TOTAL P_{TOE} = 1812 – 404 + 673 + 303 – 393 – 168
= 1821 PSF

CALCULATIONS FOR FLOOD WALLS

BEARING PRESSURE ANALYSIS (p. 5-1)

$\phi = 34^\circ$ $\quad c = 0$

$N_q = 29.44$ $\quad N_\gamma = 31.15$

$\epsilon_{qd} = \epsilon_{\gamma d} = 1 + 0.1\left(\frac{5}{6.25}\right)(1.881)$

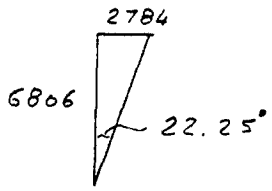
$= 1.150$

$\Sigma V = 6806 - 1959 + 959 + 1959 - 1959$

$= 6806$

$\Sigma H = 2159 + 944 - 319$

$= 2784$



$\Sigma M_A = 16560 + 944(1.833) - 319(1.833)$

$= 17705.63$

$R = \frac{17705.63}{6806} = 2.6$

$e = 3.125 - 2.6 = 0.525$

$\bar{B} = 6.25 - 2(0.525) = 5.20$

$\epsilon_{qi} = \left(1 - \frac{22.25}{90}\right)^2 = 0.567$

$\epsilon_{\gamma i} = \left(1 - \frac{22.25}{34}\right)^2 = 0.119$

BASE TILT FACTOR = 1.0

$\epsilon_{\gamma g} = \epsilon_{qg} = [1 - \tan(0)]^2 = 1.0$

$q_0 = (0.120)(5) = 0.60$

$Q = (5.2)\Big[(1.15)(0.567)(1)(1)(0.6)(29.44) + (0.5)(1.15)(0.119)(1)(1)(5.2)(0.073)(31.15)\Big]$

$= 64.10$

$F.S = \frac{64.10}{6.806} = 9.42$ O.K

SLIDING CRITERIA

$SRF = \frac{P_i}{\Sigma V \tan\phi} = \frac{2784}{6806(0.675)}$

$= 0.606 \Rightarrow F.S = 1.65$

SLIDING IS ADEQUATE

MIN "d" (p. 9-5)

$M_u = (1.9)(4.66) = 8.854$

$d_{min} = \left[\frac{(8.854)(12)/0.9}{0.85(4)(0.137)(12)\left(1 - \frac{0.137}{2}\right)}\right]^{1/2}$

$= 4.76"$

$\frac{2.5"}{7.26"}$ CL + 1/2 BAR

$d_a = 12" + 4 = 16"$ O.K

$\frac{M_u}{b d^2} = \frac{8854}{(13.5)^2} = 48.6$

$\rho = 0.000\,93$

$A_s = 0.151\ in^2/FT$

#4 @ 1'-0"

#3 @ 9"

CALCULATIONS FOR FLOOD WALLS

DESIGN CRITERIA

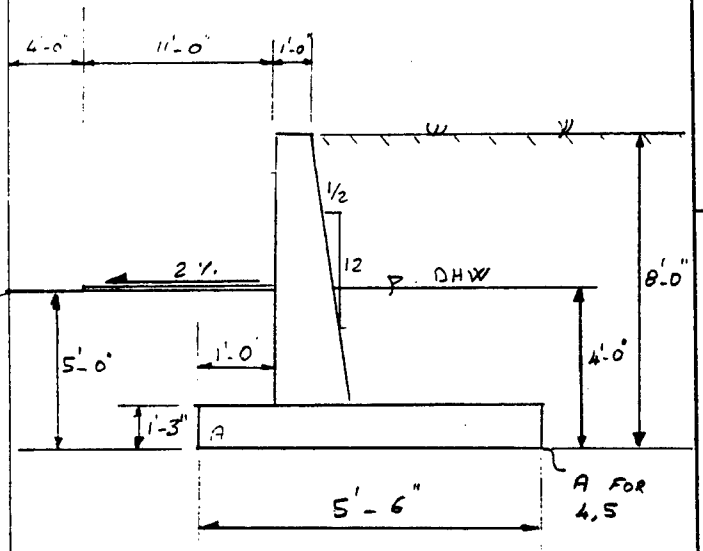
SOIL PARAMETERS FROM PAGE B-25

BACKFILL : $\phi = 32^\circ$
$\gamma = 120$ PCF
$\gamma_s = 130$ PCF

INSITU : $\phi = 34^\circ$

STA 168+00

HEIGHT OF THE WALL : 8'-0"



SRF = 2/3
$\phi_d = 22.62^\circ$

$\gamma_{SUB} = 73.2$ PCF

$P_{DRY} = 1/2\ (53.3)\ H^2$

$P_{SUB} = 1/2\ (32.2)\ H^2$

USE GEG #10 FOR WALL DESIGN

THE LAW OF SUPERPOSITION IS USED TO GET THE TOTAL HEEL AND TOE PRESSURE.

INPUT	1	2	3	4	5	BUOY
H	8.0	4.0	4.0	4.0	4.0	
B	5.5	5.5	5.5	5.5	5.5	
W	1.0	1.167	1.167	1.167	1.167	
T	1.25	1.25	1.25	1.25	1.25	
SW	130	0	0	0	0	
E	53.3	0	62.4	21.1	0	
S	0	0	0	0	0	
P	10	0	0	0	0	
A	1.0	1.0	1.0	2.167	2.167	
C	3.75	0	0	0	0	
F	0.5	0.5	0.5	0.5	0.5	
P_{HEEL}	257	165	33	321	276	-107
P_{TOE}	1790	393	525	238	282	-745
ΣH	1706	0	499	169	0	
ΣV	5631	1536	1536	1536	1536	
ΣM_A	11622	3650	2985	4015	4240	

TOTAL $P_{HEEL} = 257 - 165 + 33 + 321 - 276 - 107$
$= 63$ PSF

TOTAL $P_{TOE} = 1790 - 393 + 525 + 238 - 282 - 745$
$= 1133$ PSF

BEARING PRESSURE ANALYSIS

$\phi = 34^\circ$ $C = 0$
$N_q = 29.44$ $N_\gamma = 31.15$

$\epsilon_{qd} = \epsilon_{\gamma d} = 1 + 0.1\left(\frac{5}{5.5}\right)(1.881)$

$= 1.17$

$\Sigma V = 5631$

$\Sigma H = 1706 + 499 - 169$
$= 2036.$

ROCHESTER - ZUMBRO RIVER - PHASE 1-S

JOB NO. 4283.5 - 18

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SHEET 7 OF
MADE FKD DATE 3/10/88
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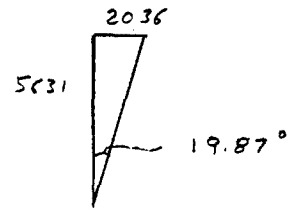
CALCULATIONS FOR FLOOD WALLS



$\Sigma M_A = 11622 + 499(1.33) - 169(1.33)$

$= 12060.9$

$R = \frac{12061}{5631} = 2.14$

$e = 2.75 - 2.14 = 0.610$

$\bar{B} = 5.5 - 2(0.61) = 4.28$

$\epsilon_{qi} = \left(1 - \frac{19.87}{90}\right)^2 = 0.607$

$\epsilon_{\gamma i} = \left(1 - \frac{19.87}{34}\right)^2 = 0.173$

BASE TILT FACTOR = 1.0

$\epsilon_{\gamma 2} = \epsilon_{q2} = [1 - \tan(0)]^2 = 1.0$

$q_o = (0.120)(5) = 0.60$

$Q = (4.28)[(1.170)(0.607)(1)(1)(0.6)(29.44) + (0.5)(1.170)(0.175)(1)(1)(4.28)(0.073)(31.15)]$

$= 57.96$

$F.S = \frac{57.96}{5.63} = 10.30$ O.K

SLIDING CRITERIA

$SRF = \frac{2036}{5631(0.675)}$

$= 0.536 \Rightarrow FS = 1.87$

SLIDING IS ADEQUATE

MIN "d"

$M_u = (1.9)(2876 = 5464.4$

$d_{min} = \left[\frac{(5.464)(12)/0.9}{(0.85)(4)(0.137)(12)\left(1 - \frac{0.137}{2}\right)}\right]^{1/2}$

$= 3.74$
4.0
7.74

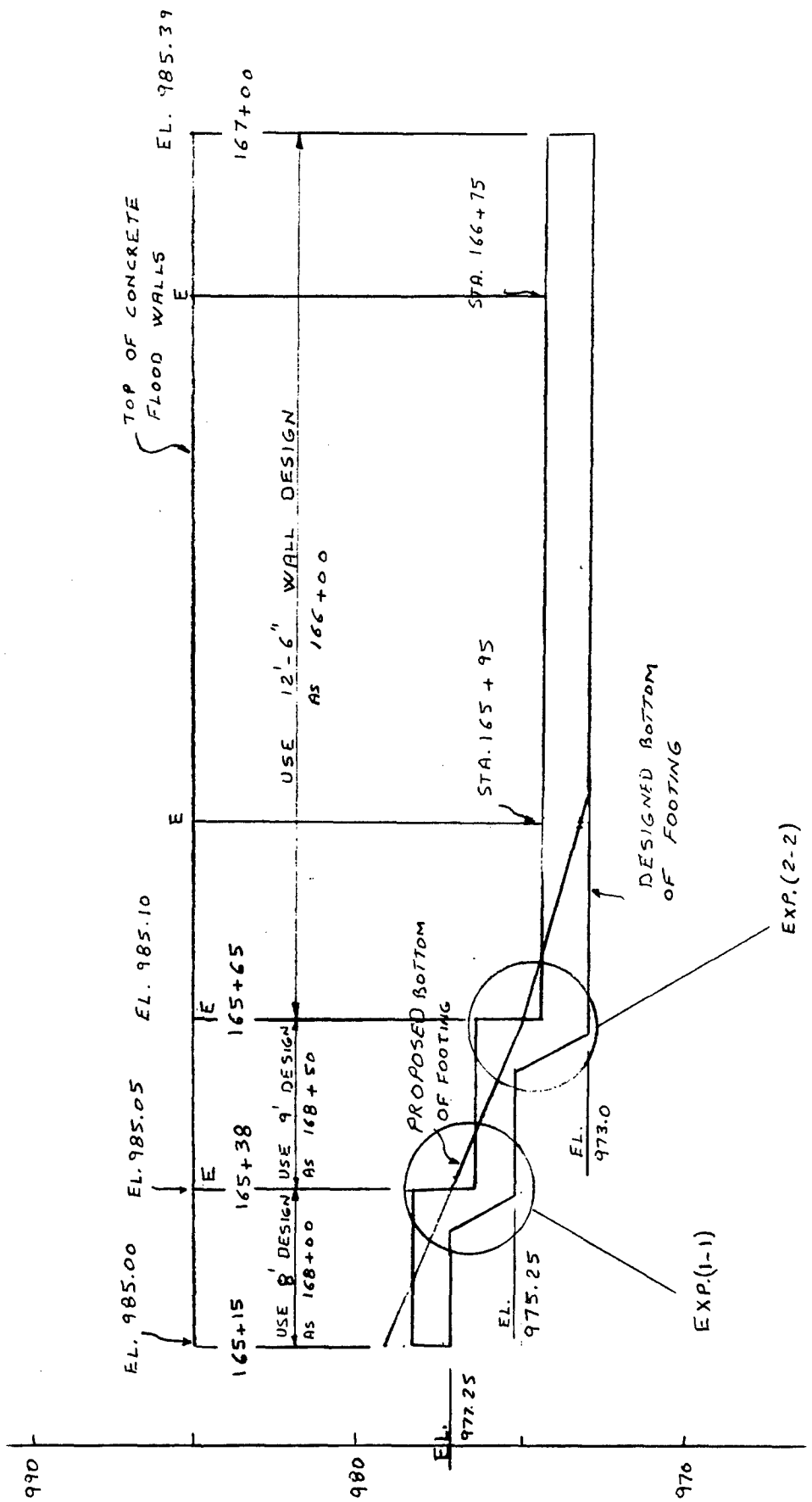
$d_a = 12" + 3.38 = 15.38"$ O.K

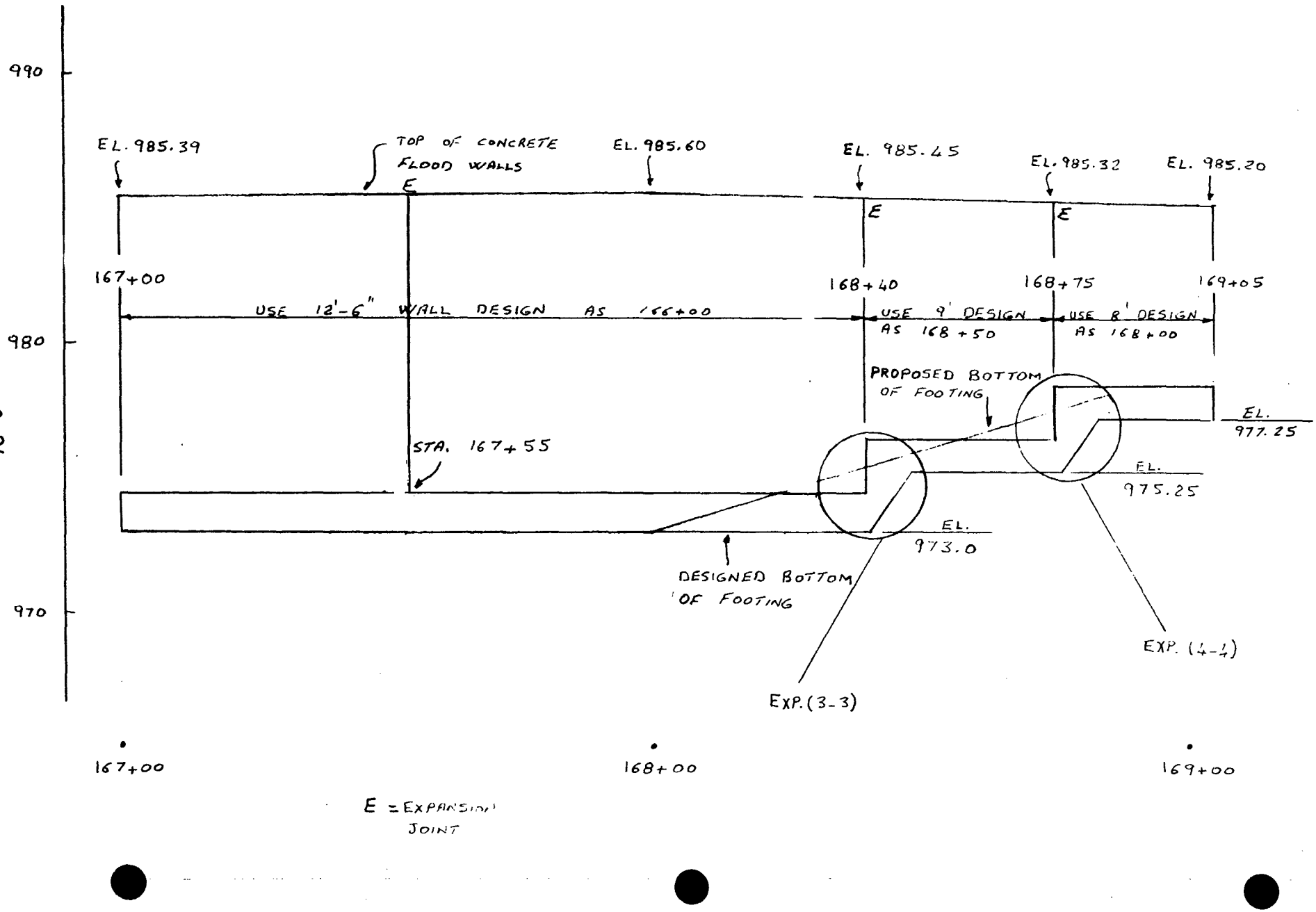
$\frac{M_u}{bd^2} = \frac{5464}{(11.4)^3} = 42$

$\rho = 0.000083$

$A_s = 0.11 \text{ in}^2/\text{FT}$

4 @ 1-0


EL. 985.39
167+00
TOP OF CONCRETE FLOOD WALLS
E
STA. 166+75
USE 12'-6" WALL DESIGN AS 166+00
STA. 165+95
DESIGNED BOTTOM OF FOOTING
EXP. (2-2)
EL. 985.10
165+65
PROPOSED BOTTOM OF FOOTING
EL. 973.0
EL. 985.05
165+38
USE 9' DESIGN AS 168+50
EL. 985.00
165+15
USE 8' DESIGN AS 168+00
EL. 975.25
EXP. (1-1)
EL. 977.25
990
980
970
167+00
166+00
165+00
E = EXPANSION JOINT



C-26

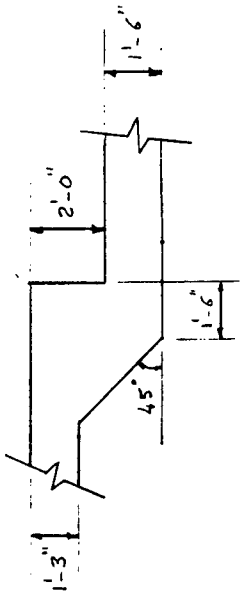
ROCHESTER - NUMBER 3
RIVER - PHASE 3

FLOOD WALLS
4283.5

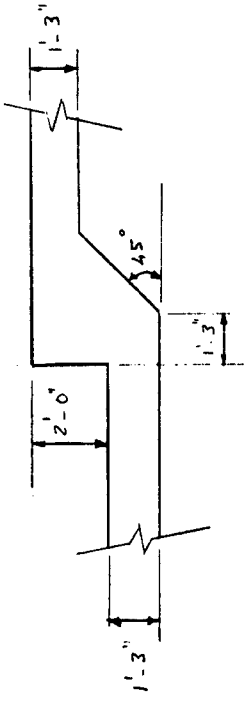
FKD
CEW

3/11/33
3-22-88

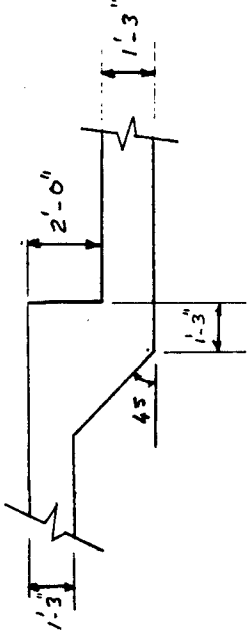
EXP. (2-2)



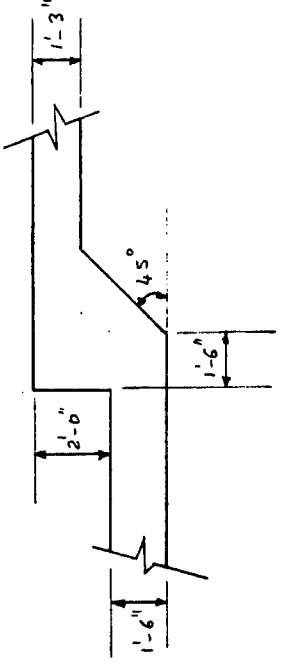
EXP. (4-4)



EXP. (1-1)



EXP. (3-3)



CALCULATIONS FOR FLOOD WALLS

DESIGN CRITERIA

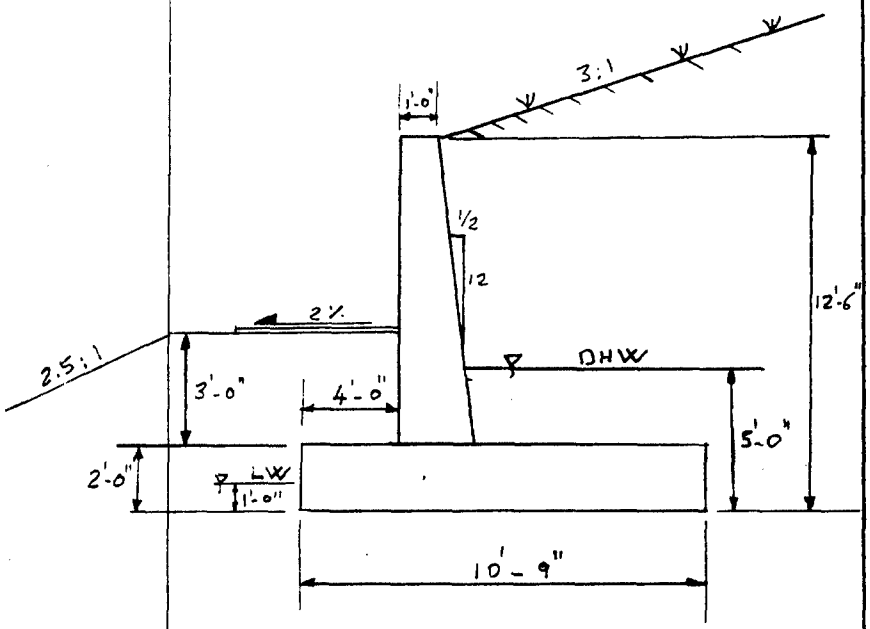
BACKFILL : $\phi = 32^\circ$
$\gamma = 120$ PCF
$\gamma_s = 130$ PCF

INSITU : $\phi = 34^\circ$

STA : 180 + 00

(DESIGN FOR WORST CASE)

HEIGHT OF THE WALL : 12'-6"



FROM EM 1110-2-XXXX p. 3-7

SRF = 2/3

$\tan\phi_d = (2/3)\tan(32) = 0.417$

(p. 3-21)

$C_1 = 2\tan\phi_d = 2(0.417) = 0.834$

$\beta = \tan^{-1}(1/3) = 18.44^\circ$

$$C_2 = \frac{\tan\phi_d(1 - \tan\phi_d \cdot \tan\beta) - \tan\beta}{\tan\phi_d}$$

$$= \frac{(0.417)\left[1 - (0.417)(0.333)\right] - 0.333}{0.417}$$

$C_2 = 0.063$

$$\alpha = \tan^{-1}\left(\frac{-C_1 - \sqrt{C_1^2 + 4C_2}}{2}\right)$$

$$= \tan^{-1}\left(\frac{-0.834 - \sqrt{(0.834)^2 + 4(0.063)}}{2}\right)$$

$= -42.10^\circ$

FLUID PRESSURE COEFFICIENT (p. K-3

$\tan\alpha = 0.904$, $\cot\alpha = 1.107$

$\sin\alpha = 0.670$, $\cos\alpha = 0.743$

$$K = \frac{1 - \tan\phi_d \cot\alpha}{1 + \tan\phi_d \tan\alpha}$$

$$= \frac{1 - (0.417)(1.107)}{1 + (0.417)(0.904)} = 0.391$$

$$K_1 = K\left(\frac{\tan\alpha}{\tan\alpha - \tan\beta}\right)\left(\frac{h}{h_w}\right)^2$$

$$= 0.391\left(\frac{0.904}{0.904 - 0.333}\right)\left(\frac{12.42}{10.5}\right)^2$$

$= 0.866$

$$K_b = K\left[1 + \left\{\left(\frac{\tan\alpha}{\tan\alpha - \tan\beta}\right)\left(\frac{h}{h_w}\right)^2 - 1\right\}\left(\frac{\gamma_M}{\gamma_b}\right)\right]$$

$$= 0.391\left[1 + \left\{(1.583)(1.399) - 1\right\}\left(\frac{0.12}{0.073}\right)\right]$$

$= 1.172$

$P_{DRY} = \frac{1}{2} K_1 \gamma H^2 = \frac{1}{2}(0.866)(120) H^2$

$= \frac{1}{2}(104) H^2$

$\gamma_{SUB} = 120 - (0.75)(62.4) = 73.2$

$P_{SUB} = \frac{1}{2}(1.172)(73.2) H^2$

$= \frac{1}{2}(85.8) H^2$

ROCHESTER - ZUMBRO RIVER - PHASE B
JOB NO. 4283.5 - 13

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CALCULATIONS FOR FLOOD WALLS

$F_1 = (104)(7.5) = 780$
$F_2 = (85.8)(5) + 780 = 1209$
$F_3 = (104)(12.5) = 1300$

$F_4 = 1300 - 1209 = 91$

$E(5) = 91$

$E = 18$ PSF

USE GEG #10 FOR WALL DESIGN

THE LAW OF SUPERPOSITION IS USED TO GET THE TOTAL HEEL AND TOE PRESSURE.

INPUT	1	2	3	4	5	BUOY.
H	12.5	5.0	5.0	5.0	5.0	
B	10.75	10.75	10.75	10.75	10.75	
W	1.0	1.31	1.31	1.31	1.31	
T	2.0	2.0	2.0	2.0	2.0	
SW	120	0	0	0	0	
E	104	0	62.5	18	0	
S	0	0	0	0	0	
P	10	0	0	0	0	
A	4	4	4	5.313	5.313	
C	3	0	0	0	0	
F	0.5	0.5	0.5	0.5	0.5	
P_{HEEL}	119	335	268	357	337	-49
P_{TOE}	2404	379	447	358	377	-1000
ΣH	8125	0	781	225	0	
ΣV	13564	3843	3843	3843	3843	
ΣM_A	50902	20229	18927	20665	21040	

TOTAL $P_{HEEL} = 119 - 335 + 268 + 357 - 337 - 49$
$= 23$ PSF

TOTAL $P_{TOE} = 2404 - 379 + 447 + 358 - 377 - 1000$
$= 1453$ PSF

C-29

BEARING PRESSURE ANALYSIS (p. E-1)

$\phi = 34°$ $\quad c = 0$

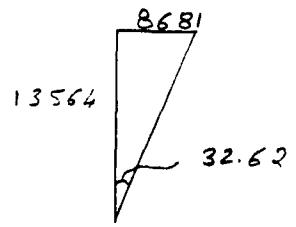
$N_q = 29.44$ $\quad N_\gamma = 31.15$

$\epsilon_{qd} = \epsilon_{\gamma d} = 1 + 0.1\left(\frac{5}{10.75}\right)(1.881)$

$= 1.087$

$\Sigma V = 13564$

$\Sigma H = 8125 + 781 - 225 = 8681$



$\Sigma M_A = 50902 + 781(1.67) - 225(1.67)$
$= 51831$

$R = \frac{51831}{13564} = 3.82$

$e = 5.375 - 3.82 = 1.56$

$\bar{B} = 10.75 - 2(1.56) = 7.64$

$\epsilon_{qi} = \left(1 - \frac{32.62}{90}\right)^2 = 0.406$

$\epsilon_{\gamma i} = \left(1 - \frac{32.62}{34}\right)^2 = 0.002$

BASE TILT FACTOR = 1.0

$\epsilon_{\gamma g} = \epsilon_{qg} = [1 - \tan(0)]^2 = 1.0$

$q_o = (0.12)(5) = 0.60$

$Q = (7.64)\Big[(1.087)(0.406)(1)(1)(0.6)(29.44)$

$+ (0.5)(1.087)(0.0028)(1)(1)(7.56)(0.073)(31.15)$

CALCULATIONS FOR FLOOD WALLS

$Q = (7.64)(7.80 + 0.02)$

$= 59.75$

$F.S = \frac{59.75}{13.56} = 4.40$ O.K

SLIDING CRITERIA

$K_p = \frac{1 + \sin\phi_d}{1 - \sin\phi_d} = \frac{1 + 0.385}{1 - 0.385}$

$= 2.25$

$SRF = \frac{P_1 - P_3}{\Sigma V \tan\phi} \Rightarrow$

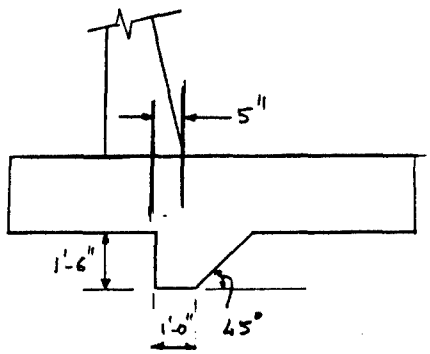
$P_3 = 8681 - (2/3)(13564)(0.675)$

$= 2577.2$

$\left[\frac{1}{2}(130)(H)^2\right](2.25) = 2577.2$

$H = 4.2'$

ADD 1'-6" Key to the bottom of the footing.



MIN "d" (p. 9-5)

$M_u = (1.9)(20.2) = 38.5$

$d_{min} = \sqrt{\frac{(38.50)(12)/0.9}{(0.85)(4)(0.137)(12)(1 - 0.137/2)}}$

$= 9.9$

2.5_n 1/2" BAR + CL.

12.40

$d_u = 12" + 5.25" = 17.25$ O.K.

$\frac{M_u}{bd^2} = \frac{38500}{(14.75)^2} = 177$

$\rho = 0.00333$

$A_s = 0.59$ in²/FT

USE #7 @ 1'-0"

OR #6 @ 9"

ROCHESTER - ZUMBRO RIVER - PHASE B
JOB NO. 4233.5 - 1B

Wallace Holland Kastler Schmitz & Company
Consulting Engineers & Planners
Mason City, Iowa & Rochester, Minnesota

SHEET 14 OF
MADE FKD DATE 3/15/88
CHECKED CEW DATE 3-23-88

CALCULATIONS FOR FLOOD WALLS

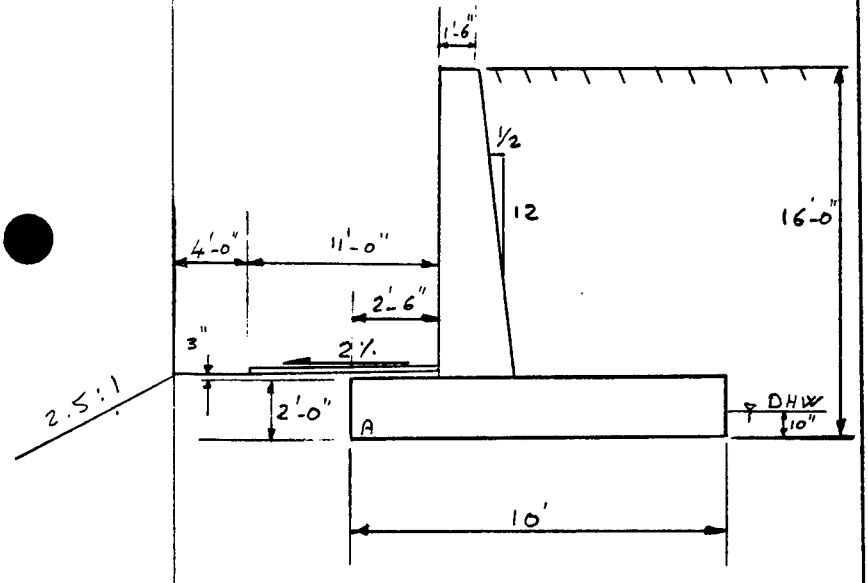
DESIGN CRITERIA

BACK FILL : $\phi = 33^\circ$
$\gamma = 120$ PCF
$\gamma_s = 130$ PCF

INSITU : ROCK

STA : 183 + 45

HEIGHT OF THE WALL: 16'-0"



SRF = 2/3 $\quad \phi_1 = 22.62^\circ$

$P_{DRY} = \frac{1}{2}(53.3)H^2$

USE GEG PROGRAM #10 FOR WALL DESIGN.

H = 16.0	SW = 130
B = 10.0	E = 53.3
W = 1.50	S = 0
T = 2.0	P = 10

A = 2.5 ; C = 0.25 ; F = 0.5

P_{HEEL} = 497 PSF
P_{TOE} = 2951 PSF

BEARING CAPACITY IS O.K

SLIDING CRITERIA

ΣH = 6822
ΣV = 17243

$$SRF = \frac{P_1}{\Sigma V \tan\phi} = \frac{6822}{(17243)(0.675)}$$

$$= 0.586 \Rightarrow F.S = 1.706$$

SLIDING IS ADEQUATE

MIN. "d" (ρ. 9.5)

$M_u = (1.9)(24.38) = 46.32$

$$d_{min} = \left[\frac{(46.32)(12)/0.9}{(0.85)(4)(0.137)(12)\left(1 - \frac{0.137}{2}\right)}\right]^{1/2}$$

= 10.90
2.50 CL + 1/2" BAR
13.40

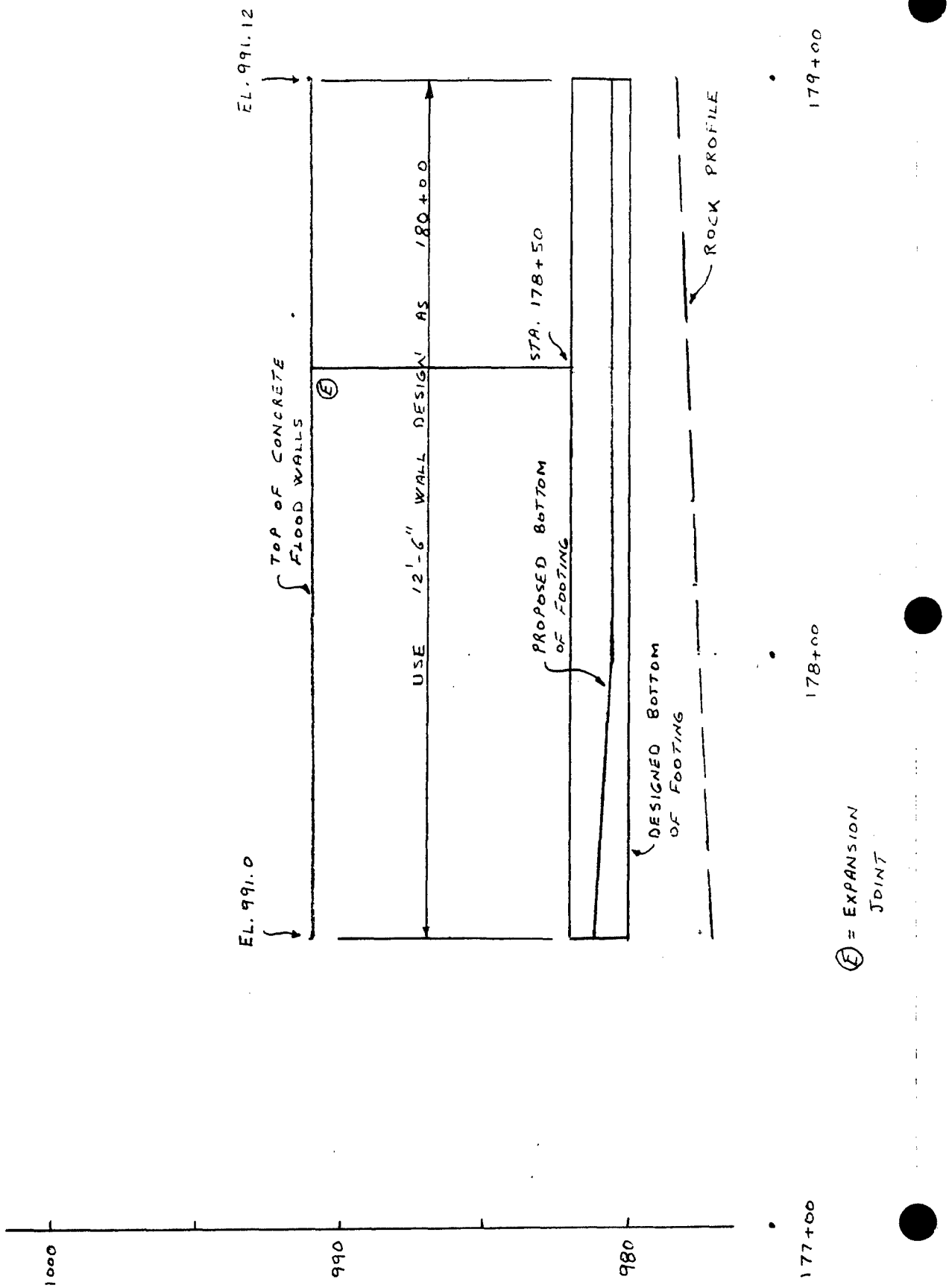
$d_a = 18" + 7.5" = 25.5$ O.K

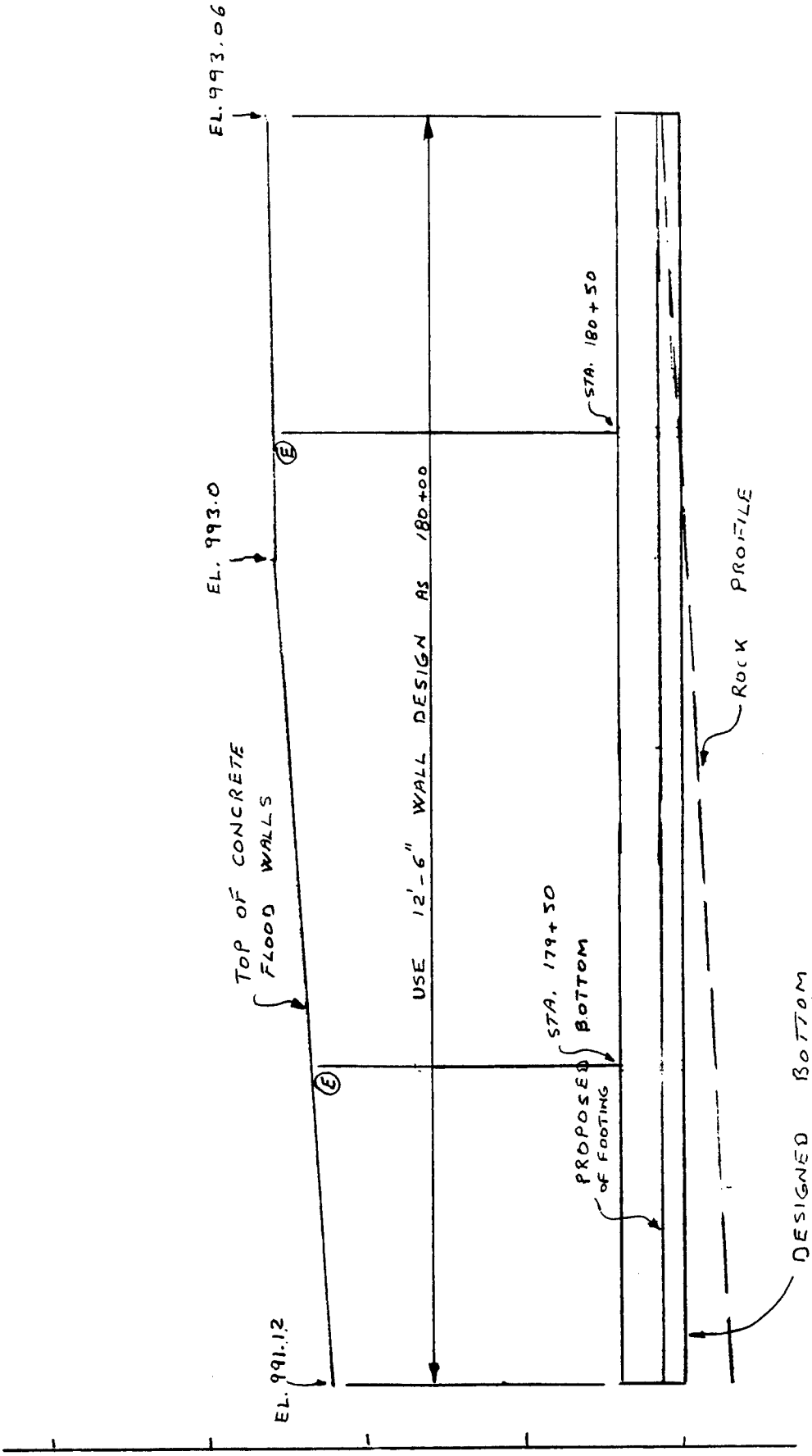
$$\frac{M_u}{bd^2} = \frac{46322}{(23)^2} = 87.56$$

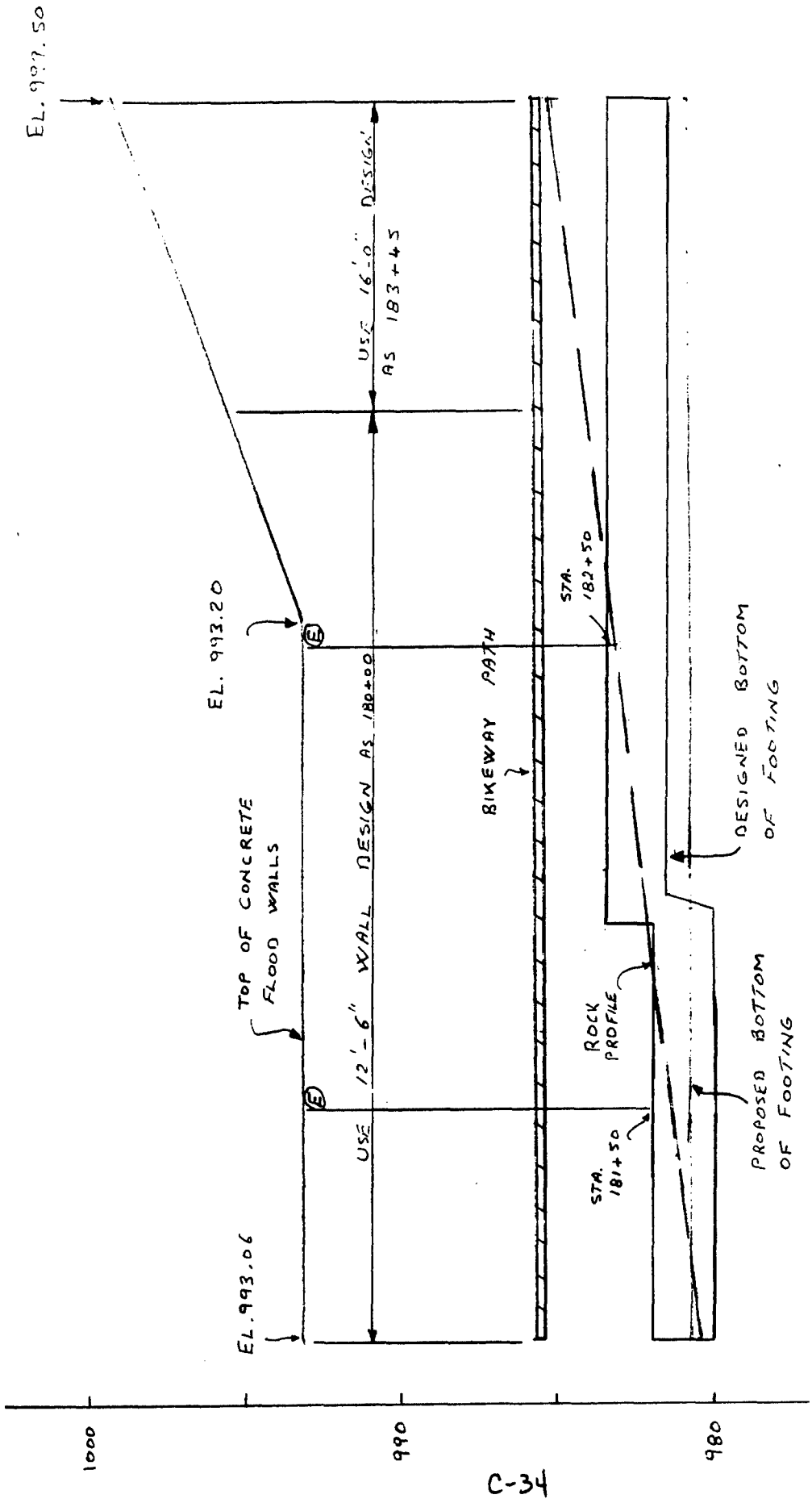
$\rho = 0.00169$

$A_s = 0.47$ in²/FT

6 @ 11"


EL. 991.12
TOP OF CONCRETE FLOOD WALLS
USE 12'-6" WALL DESIGN AS 180+00
STA. 178+50
PROPOSED BOTTOM OF FOOTING
DESIGNED BOTTOM OF FOOTING
ROCK PROFILE
EL. 991.0
179+00
178+00
177+00
1000
990
980
E = EXPANSION JOINT


EL. 993.06
EL. 993.0
EL. 991.12
TOP OF CONCRETE FLOOD WALLS
USE 12'-6" WALL DESIGN AS 180+00
STA. 180+50
STA. 179+50
PROPOSED BOTTOM OF FOOTING
ROCK PROFILE
DESIGNED BOTTOM OF FOOTING
181+00
180+00
179+00
1000
990
980
E = EXPANSION JOINT


EL. 997.50
USE 16'-0" DESIGN AS 183+45
EL. 993.20
TOP OF CONCRETE FLOOD WALLS
USE 12'-6" WALL DESIGN AS 180+00
EL. 993.06
BIKEWAY PATH
STA. 182+50
ROCK PROFILE
STA. 181+50
DESIGNED BOTTOM OF FOOTING
PROPOSED BOTTOM OF FOOTING
183+50
183+00
182+00
181+00
1000
990
980
(E) = EXPANSION JOINT

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B

COMPUTATIONS FOR FLOOD WALLS - RT. BANK
STA. 187+45 TO 193+45

BIKE PATH BRIDGE - RT. BANK
STA. 187+23 TO 189+00

STATION NUMBER	187+80	188+00	188+50	189+00	190+00	190+25	191+00	192+00	193+00	193+35	193+45
ELEV. OF TOP OF THE WALL	992.60	992.48	992.20	991.34	989.63	989.20	989.32	989.48	989.64	989.70	986.0
ELEV. OF BOT. OF THE FOOT.	984.55	983.05	979.2	975.50	975.58	975.60	975.66	975.74	975.82	978.88	979.76
HEIGHT OF THE WALL (FT)	8.05	9.43	13.0	15.84	14.05	13.60	13.66	13.74	13.82	10.82	6.24
ELEV. OF BEDROCK	977.50	977.50	977.0	977.0	975.0	975.0	974.0	NO INFO	ND INFO	NO INFO.	NO INFO.
Δ (FT)	7.05	5.55	2.20	-1.50	0.60	0.60	1.66	—	—	—	—

Approx. Rock Profile-Rt. Bank

when computing the lateral pressure against a rigid wall to make the equation values compare with the measured test values which involved very rigid walls.

Case 1: Point load. Equations in Fig. 11-19 can be used for this case, which was investigated by Spangler and others. These equations are based on mH being the perpendicular distance to the wall, as shown in Fig. 11-19. In the equations shown in the figure the given coefficients have been adjusted to make the theoretical agree with the measured pressure.

Case 2: Line load. The engineer should inspect the relative dimensions of the retaining wall and of the structure to decide if the loading may be considered a line load or a strip load (case 3). A concrete-block wall or fence could be considered a line load; a conduit laid on the ground is another example; wide strip loads may be considered as a series of parallel-line loads.

For line loads (Fig. 11-20), from the Boussinesq equations and using the ratios m, n as before,

$$\sigma_h = \frac{2q}{\pi H} \frac{m^2 n}{(m^2 + n^2)^2} \tag{11-19}$$

However, the measured values from tests were found to be approximately twice [Terzaghi (1954, p. 1252)] this value; therefore, modifying Eq. (11-19), we obtain the value shown in Fig. 11-20.

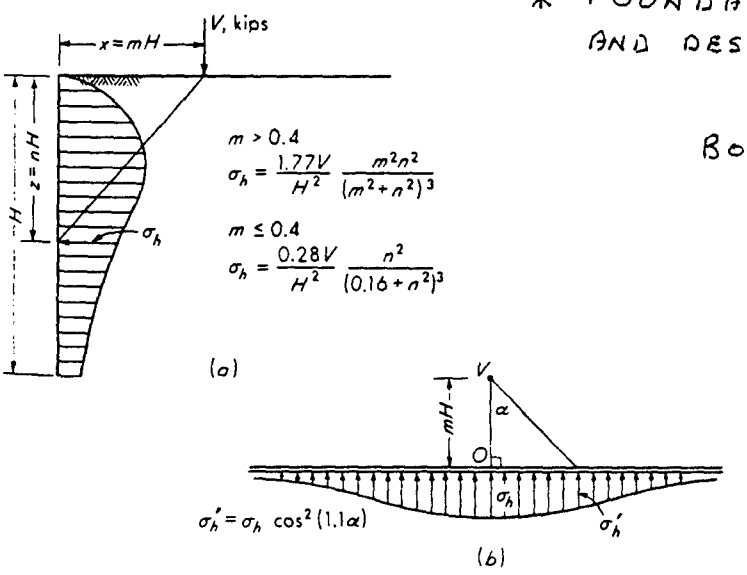
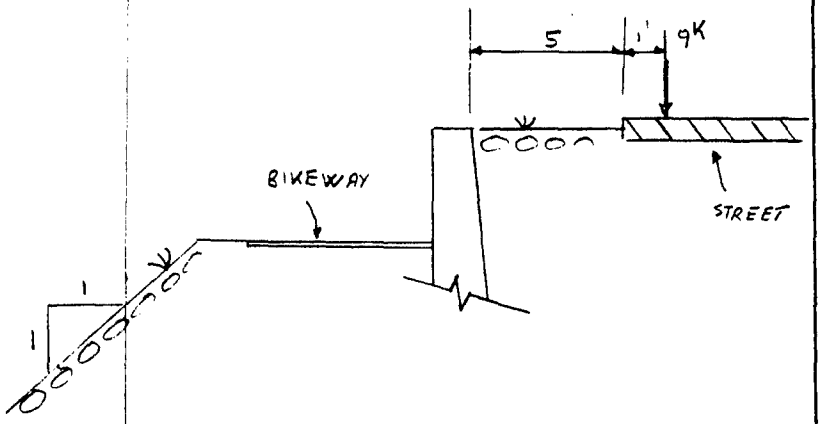


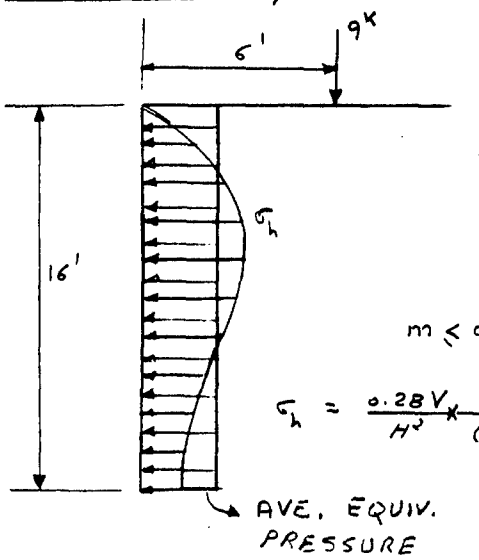
Figure 11-19 (*a*) Lateral pressure against rigid wall due to a point load and $\mu = 0.5$; (*b*) lateral pressure at points along the wall on each side of a perpendicular from the concentrated load V to the wall.

CALCULATIONS FOR FLOOD WALLS

STA: 189+00



EQUIVIALENT PRESSURE DUE TO SURCHARGE (p. 3 - 34)



$m \leq 0.4$

$$\sigma_h = \frac{0.28 V}{H^2} \times \frac{n^2}{(0.16 + n^2)^3}$$

$mH = 6 \Rightarrow m = \frac{6}{16} = 0.375$

DEPTH (FT)	PRESS. (lb/ft²)	DEPTH (FT)	PRESS. (lb/ft²)
1	8.2	9	27.2
2	26.7	10	21.8
3	44.1	11	17.3
4	52.5	12	13.8
5	52.9	13	11.13
6	48.0	14	8.9
7	41.1	15	7.3
8	33.7	16	6.0

$$\sigma_{h_c\,(AVE)} = \frac{\Sigma \sigma_{h_c}}{16} = \frac{420.63}{16}$$

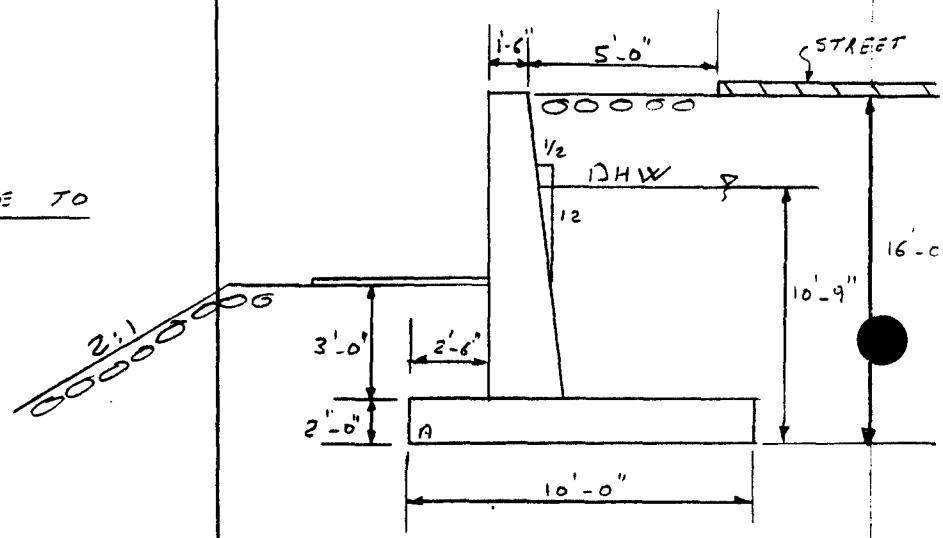
$= 26.28 \text{ lb/ft}^2$

USE 27 lb/ft^2

DESIGN CRITERIA

BACKFILL : $\phi = 32°$
$\gamma = 120$ PCF
$\gamma_s = 130$ PCF

INSITU : ROCK



INPUT	1	2	3	4	5	BUOY
H	16	10.75	10.75	10.75	10.75	
B	12.0	12.0	12.0	12.0	12.0	
W	1.5	1.72	1.72	1.72	1.72	
T	2.0	2.0	2.0	2.0	2.0	
SW	130	0	0	0	0	
E	53.3	0	62.4	21.1	0	
S	27	0	0	0	0	
P	10	0	0	0	0	
A	2.5	2.5	2.5	7.417	7.417	
C	3.0	0	0	0	0	
F	0.5	0.5	0.5	0.5	0.5	
P_{HEEL}	857	243	-295	573	755	-10,
P_{TOE}	2873	773	1432	443	261	32
ΣH	7254	0	3606	1219	0	
ΣV	22377	6097	6097	6097	6097	
ΣM_A	110069	30224	17304	38132	42500	

CALCULATIONS FOR FLOOD WALLS

TOTAL P_{HEEL} = 857 - 243 - 295 + 573 - 755 - 101 = 36 PSF

TOTAL P_{TOE} = 2873 - 773 + 1432 + 443 - 261 - 322 = 3392 PSF

BEARING PRESSURE IS O.K

SLIDING CRITERIA

ΣH = 7254 + 3606 - 1219 = 9641

ΣV = 22377.

$$SRF = \frac{P_1}{\Sigma V \tan\phi} = \frac{9641}{(22377)(0.675)}$$

= 0.638 ⇒ F.S = 1.567

SLIDING IS ADEQUATE

MIN "d"

M_u = (1.9)(54.98) = 104.47

$$d_{min} = \left[\frac{(104.47)(12)/0.9}{(0.85)(4)(0.137)(12)(1-\frac{0.137}{2})}\right]^{1/2}$$

= 16.36"

2.50

18.86" CL + 1/2" BAR

d_a = 18" + 7 = 25" O.K

$$\frac{M_u}{bd^2} = \frac{104470}{(22.5)^2} = 206.36$$

ρ = 0.00393

A_s = 1.061 in²/FT

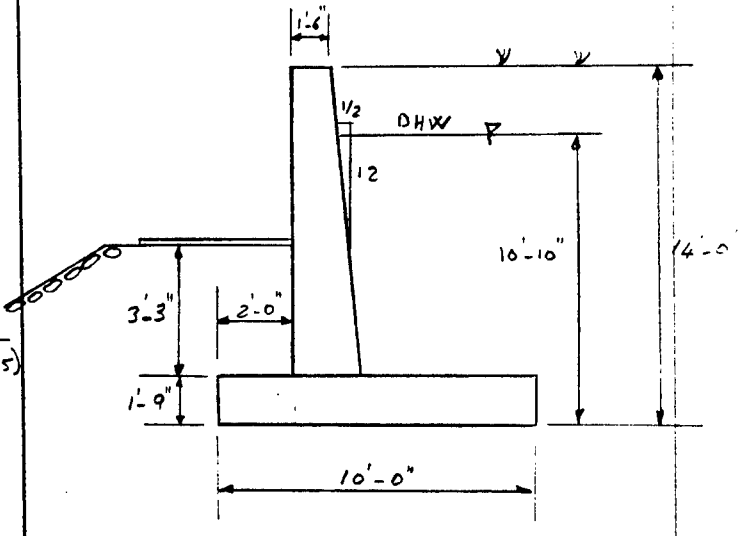
USE #9 @ 1'-0"

DESIGN CRITERIA

BACKFILL : ϕ = 32°
γ = 120 PCF
γ_s = 130 PCF

INSITU : ϕ = 32°

STA : 192+00



NO BORINGS WERE DRILLED AFTER STA. 191+00. ASSUME THE FOOTING IS ON SOIL.

SRF = 2/3

ϕ_d = 22.62°

γ_{SUB} = 73.2 PCF

$P_{DRY} = \frac{1}{2}(53.3)H^2$

$P_{SUB} = \frac{1}{2}(32.2)H^2$

USE GEG #10 FOR WALL DESIGN

THE LAW OF SUPERPOSITION IS USED TO GET THE TOTAL HEEL AND TOE PRESSURE.

ROCHESTER - ZUMBRO RIVER - PHASE 3
JOB NO. 4283.5-18

Wallace Holland Kastler Schmitz & Company
Consulting Engineers & Planners
Mason City, Iowa & Rochester, Minnesota

SHEET 5C5 OF
MADE FKD DATE 3/24/88
CHECKED DATE

CALCULATIONS FOR FLOOD WALLS

INPUT	1	2	3	4	5
H	14	10.83	10.83	10.83	10.83
B	10	10	10	10	10
W	1.5	1.63	1.63	1.63	1.63
T	1.75	1.75	1.75	1.75	1.75
SW	130	0	0	0	0
E	53.3	0	62.4	21.1	0
S	27	0	0	0	6
P	10	0	0	0	0
A	2.0	2.0	2.0	6.0	6.0
C	3.25	0	0	0	0
F	0.5	0.5	0.5	0.5	0.5
P_{HEEL}	549	200	-592	494	226
P_{TOE}	2781	821	2434	527	795
ΣH	5601	0	3659	1237	0
ΣV	16650	5103	5103	5103	5103
ΣM_A	64656	20342	7132	25786	30253

TOTAL P_{HEEL} = 549 - 200 - 592 + 494 - 226
= 25 PSF

TOTAL P_{TOE} = 2781 - 821 + 2434 + 527 - 795
= 4126 PSF

BEARING PRESSURE ANALYSIS

$\phi = 34°$ $\quad C = 0$

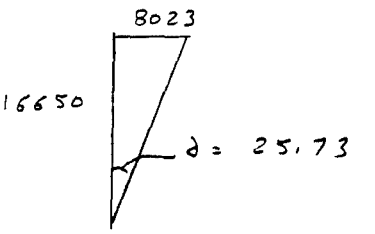
$N_q = 29.44$ $\quad N_\gamma = 31.15$

$C_{qd} = C_{\gamma d} = 1 + 0.1\left(\frac{5}{10}\right)(1.881)$

$= 1.094$

$\Sigma V = 16650$

$\Sigma H = 5601 + 3659 - 1237 = 8023$



$\Sigma M_A = 64656 + 3659(3.61) - 1237(3.61)$
$= 73399$

$R = \frac{73399}{16650} = 4.408$

$e = 5 - 4.408 = 0.592$

$\bar{B} = 10 - 2(0.592) = 8.817$

$C_{qi} = \left(1 - \frac{25.73}{90}\right)^2 = 0.510$

$C_{\gamma i} = \left(1 - \frac{25.73}{34}\right)^2 = 0.059$

BASE TILT FACTOR = 1.0

$C_{\gamma g} = C_{qg} = [1 - \tan(0)]^2 = 1.0$

$q_0 = (0.120)(5) = 0.60$

$Q = (8.817)\Big[(1.094)(0.510)(1)(1)(0.6)(29.44)$

$+ (0.5)(1.094)(0.059)(1)(1)(8.817)(0.073)(31.15$

$= 92.60$

$F.S = \frac{92.6}{16.65} = 5.56$ O.K

SLIDING CRITERIA

$K_p = 2.25$

2' OF SOIL CAUSING PASSIVE FORCE

C-40 $\quad SRF = \frac{P_1 - P_3}{\Sigma V \tan\phi}$

CALCULATIONS FOR FLOOD WALLS

$$SRF = \frac{8023 - (0.5)(130)(2)^2(2.25)}{16650(0.675)}$$

$$= 0.662 \Rightarrow F.S = 1.51$$

O.K

MIN. "d":

$$M_u = (1.9)(23.51) = 44.7$$

$$d_{min} = \left[\frac{(44.7)(12)/0.9}{(0.85)(4)(0.137)(12)\left(1 - \frac{0.137}{2}\right)}\right]^{1/2}$$

$$= 10.7''$$

$$\frac{2.5''}{13.2''} \quad \tfrac{1}{2} \text{ BAR} + \text{CL.}$$

$$d_u = 18'' + 6.125 = 24.125''$$

$$\frac{M_u}{bd^2} = \frac{44700}{(21.73)^2} = 95$$

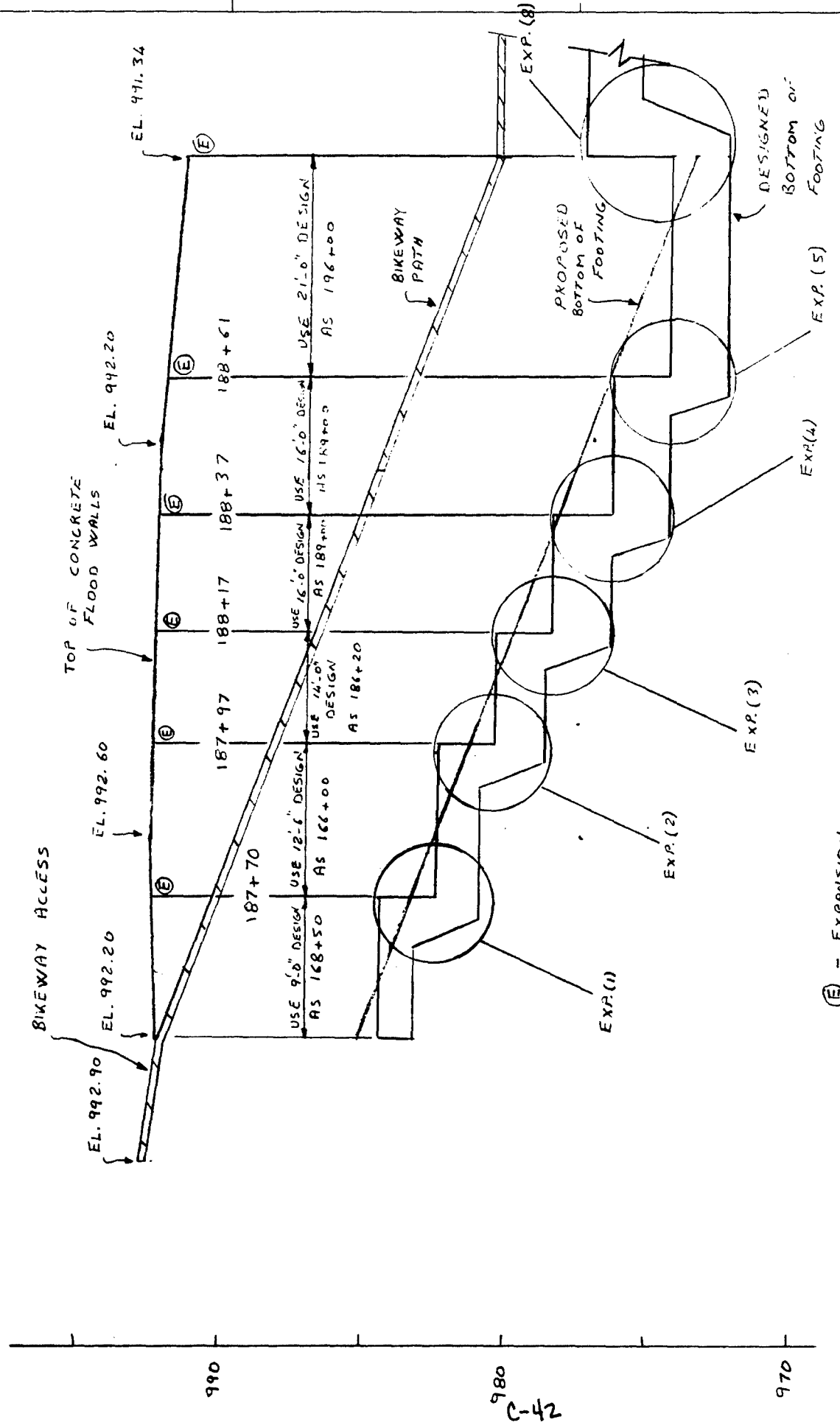
$$\rho = 0.00178$$

$$A_s = 0.464 \text{ in}^2/\text{FT}$$

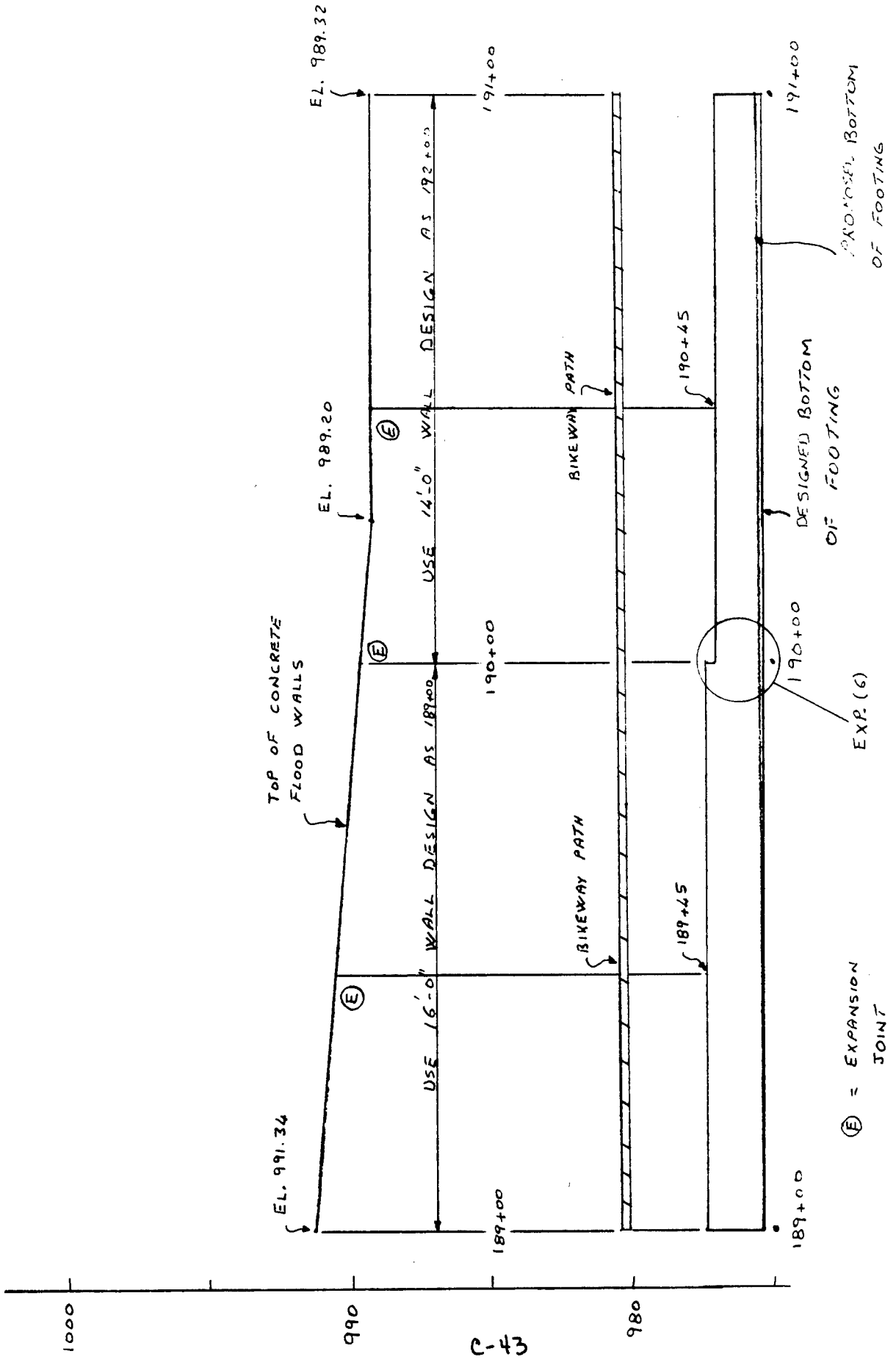
USE #6 @ 10"

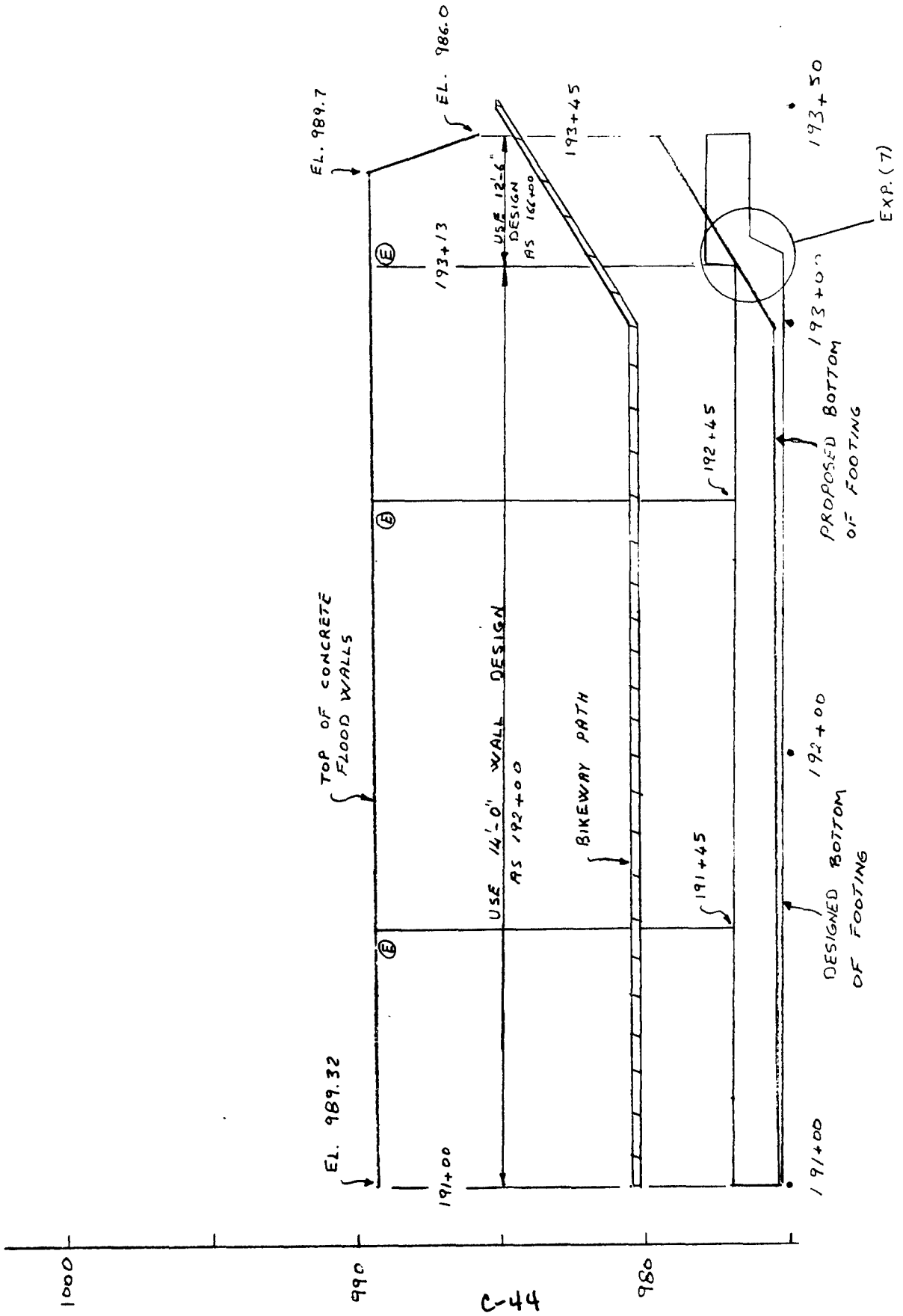
ROCHESTER - ZUMBRO RIVER - PHASE B | FLOOD WALLS 4283.5 | FKD 3/25/88

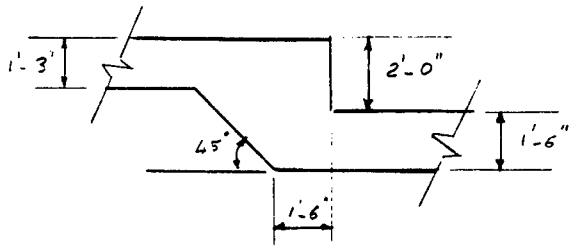
SC 7



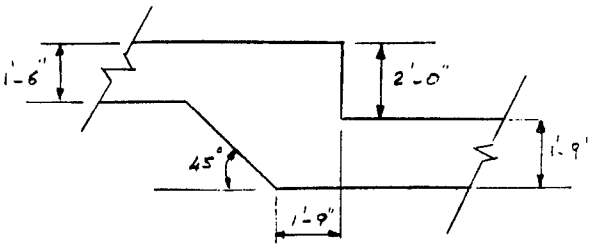
ROCHESTER - ZUMBRO RIVER _ PHASE B | FLOOD WALLS 4283.5 | FKD | 3/24/88 | SCB



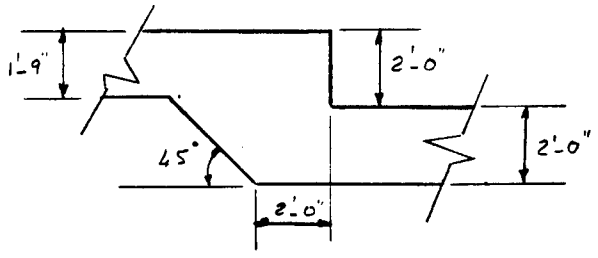

EL. 989.7
EL. 986.0
193+45
193+50
193+13
USE 12'-6" DESIGN AS 166+00
EXP. (7)
192+45
PROPOSED BOTTOM OF FOOTING
TOP OF CONCRETE FLOOD WALLS
USE 14'-0" WALL DESIGN AS 192+00
BIKEWAY PATH
191+45
192+00
DESIGNED BOTTOM OF FOOTING
EL. 989.32
191+00
191+00
1000
990
980



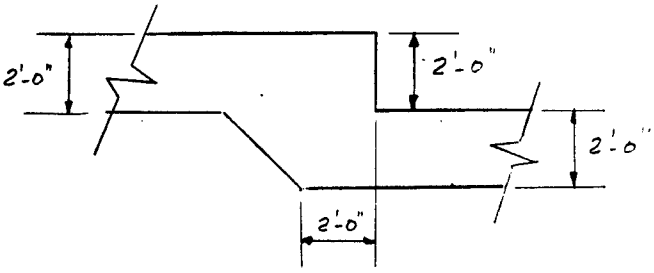
EXP. (1)



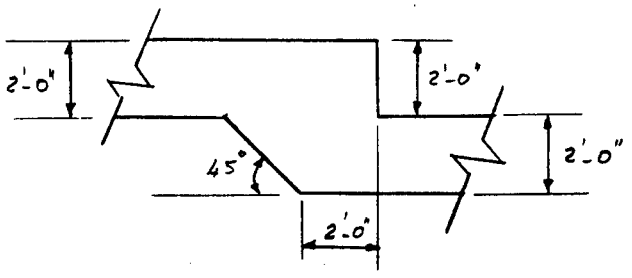
EXP. (2)



EXP. (3)



EXP. (4)



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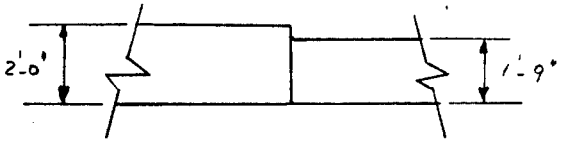
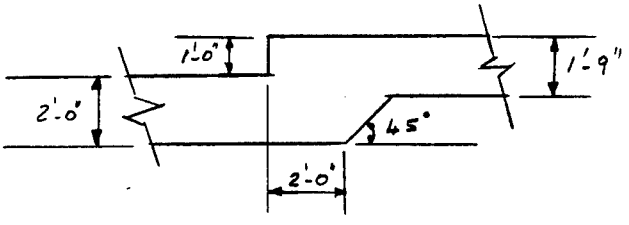
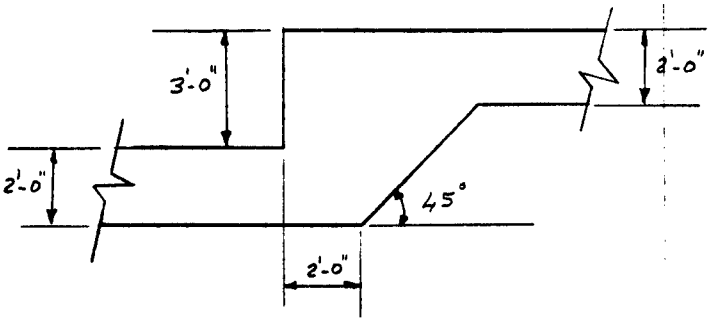


EXP. (6)



EXP. (7)



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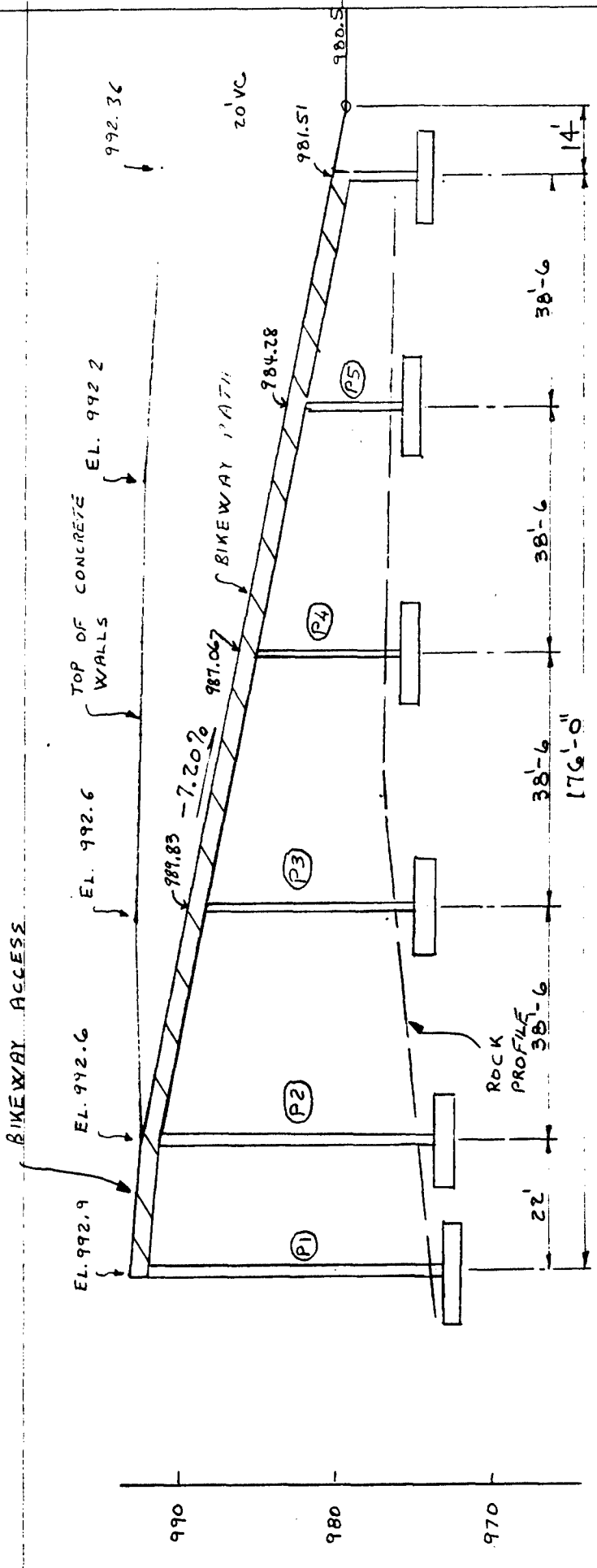
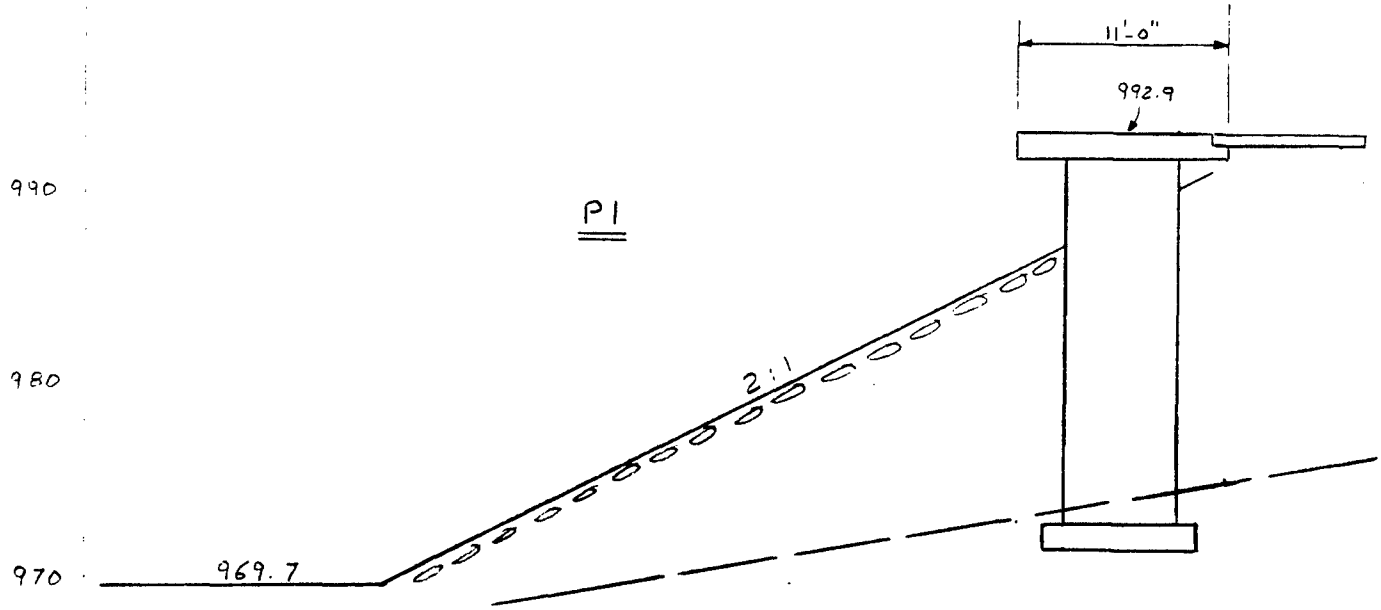
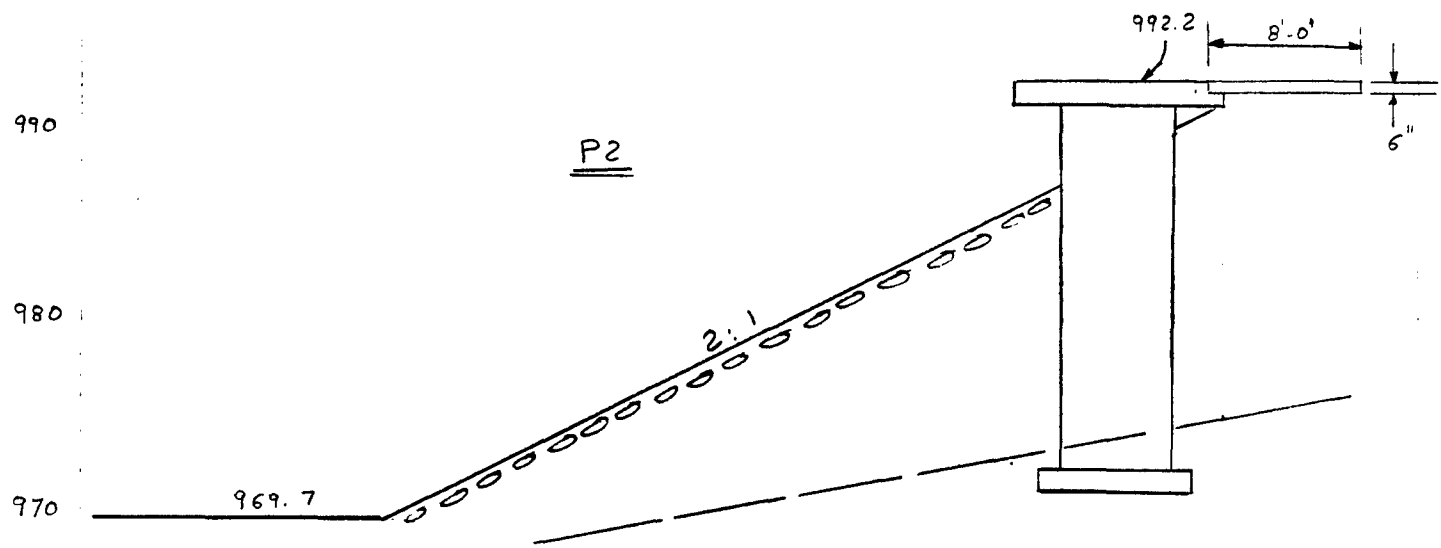


BRIDGE PROFILE



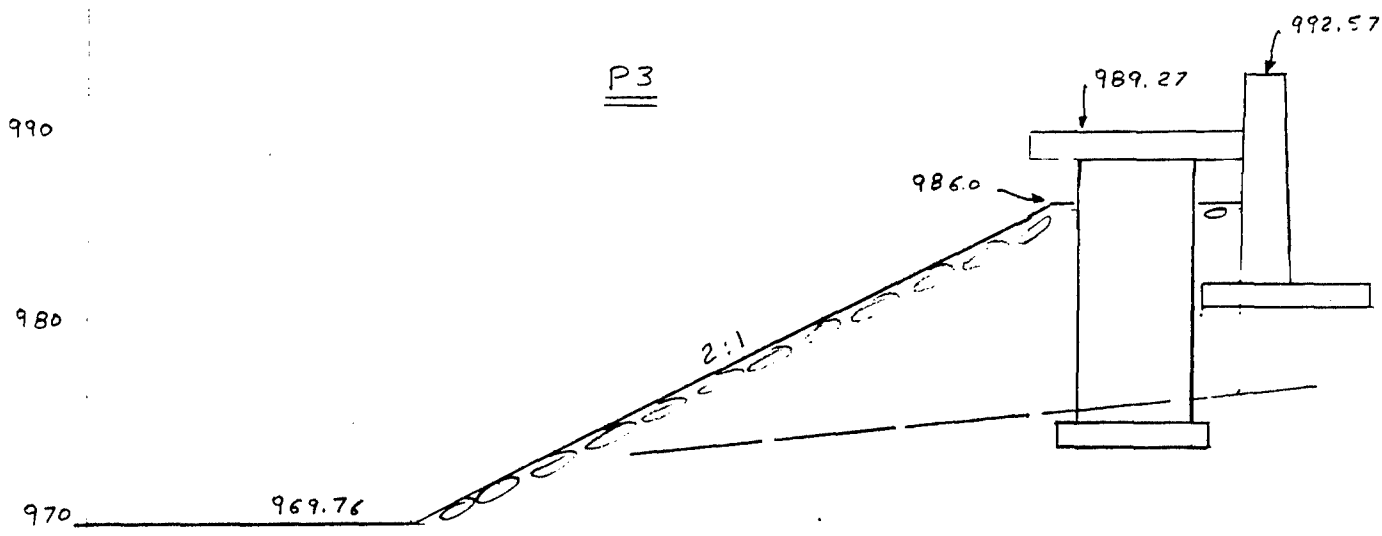
187 + 23



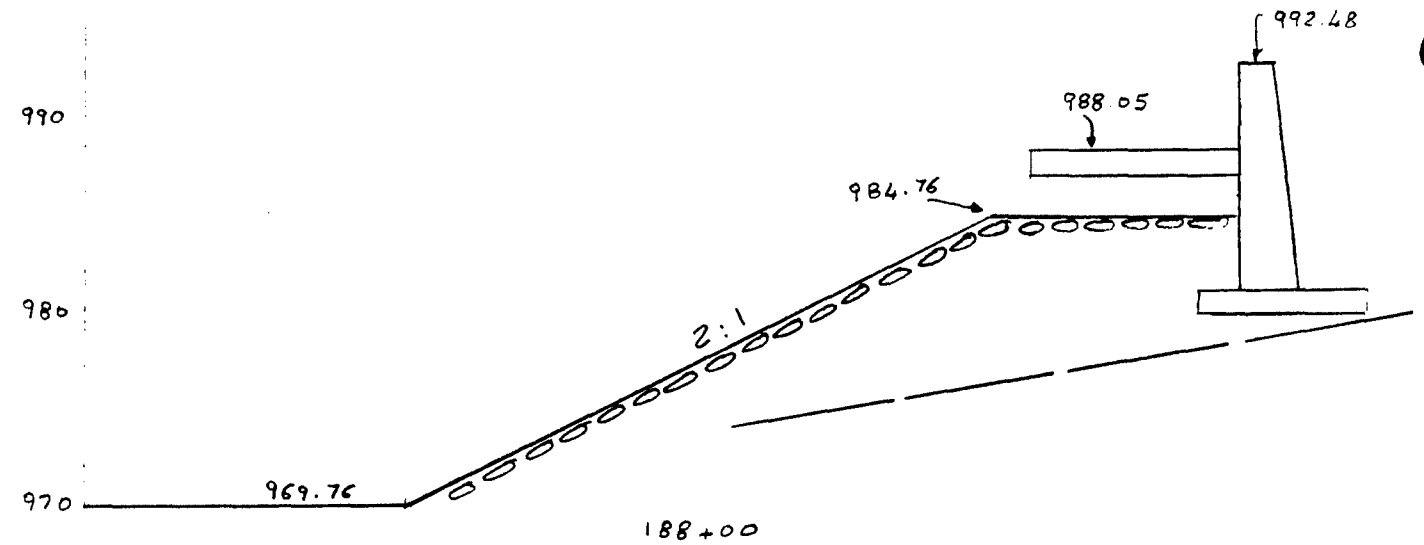
187+45

PIER DIMENSIONS:

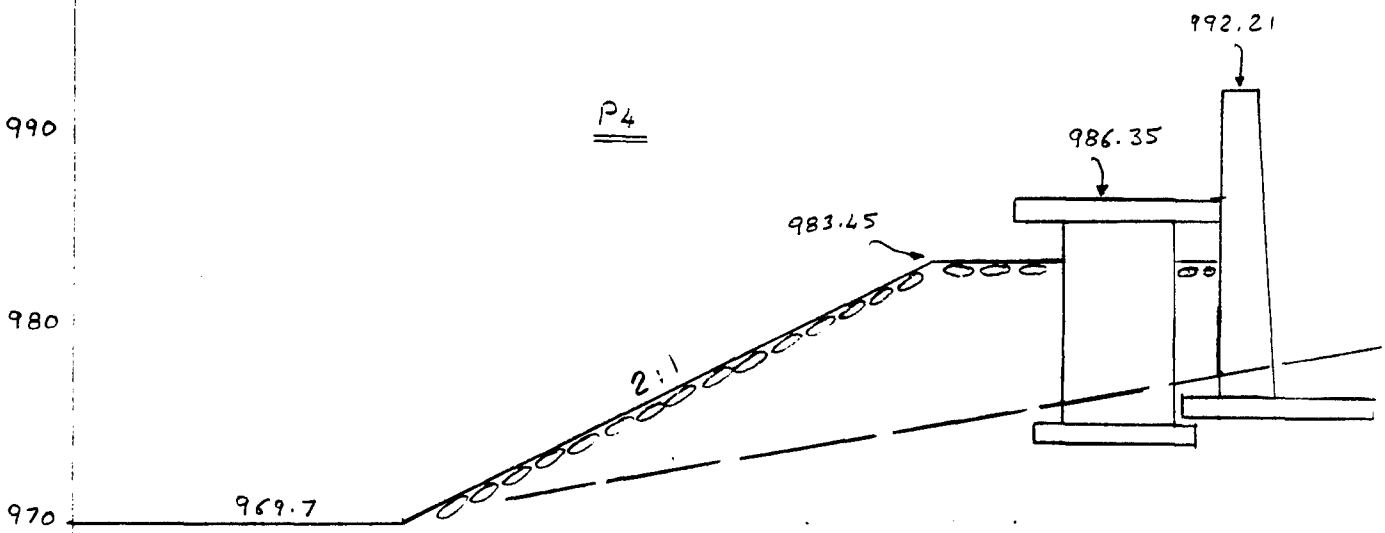
SHAFT : 6'-0" x 1'-0"
SLAB THICKNESS : 1'-2"
FOOTING : 6'-0" x 8'-0" x 1'-2"



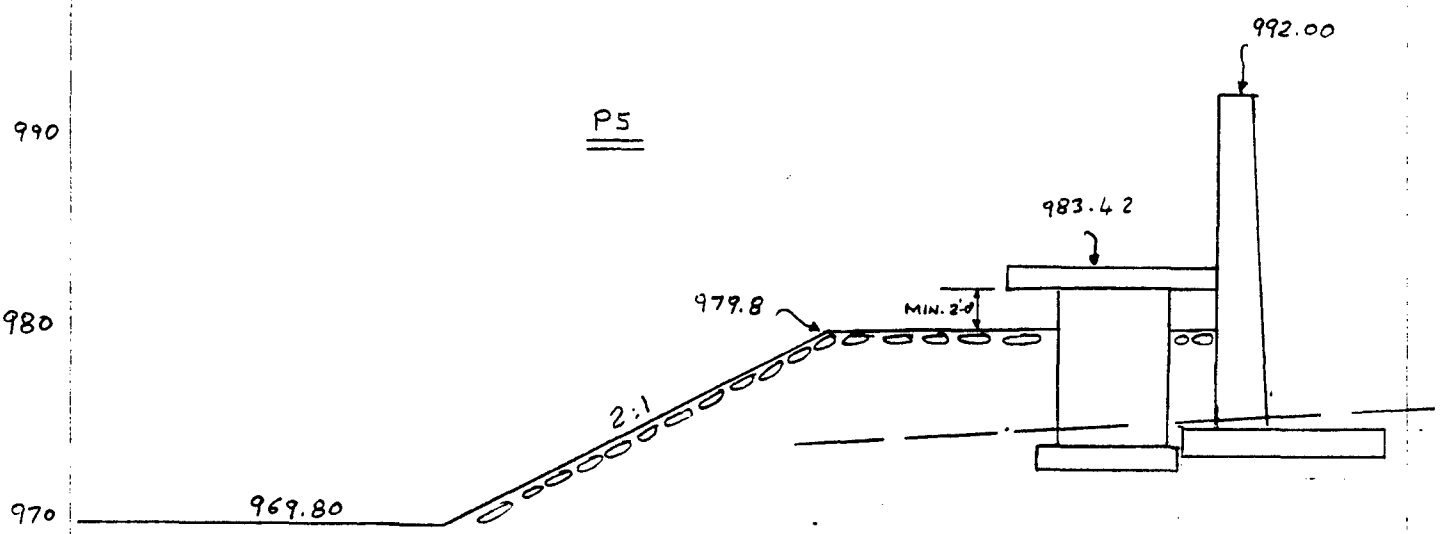
187 + 83.75



188 + 00

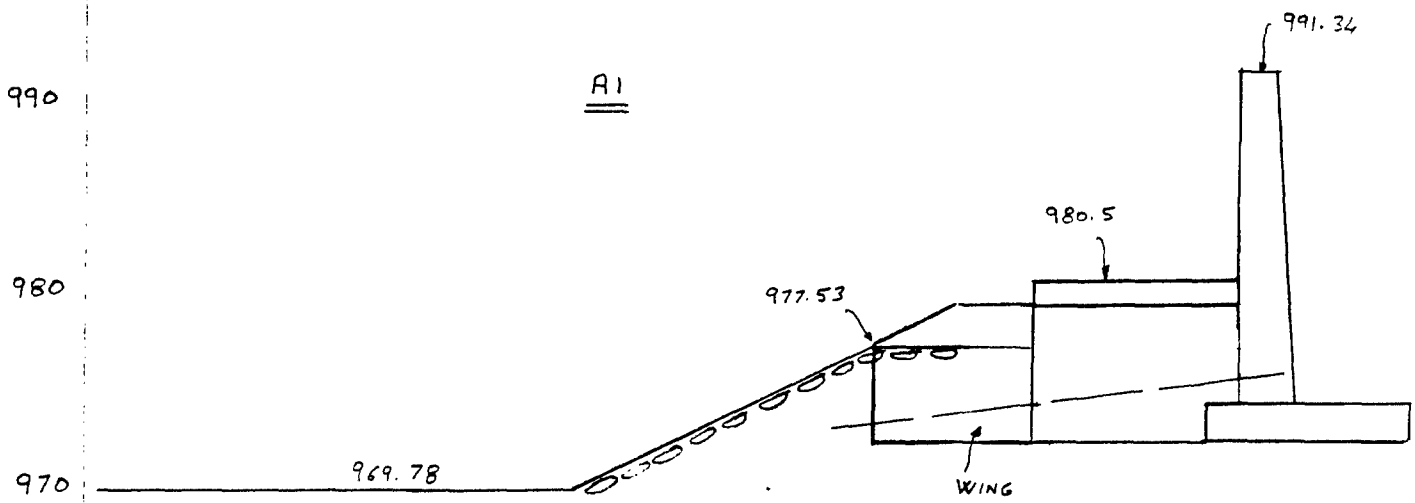


188 + 22.50

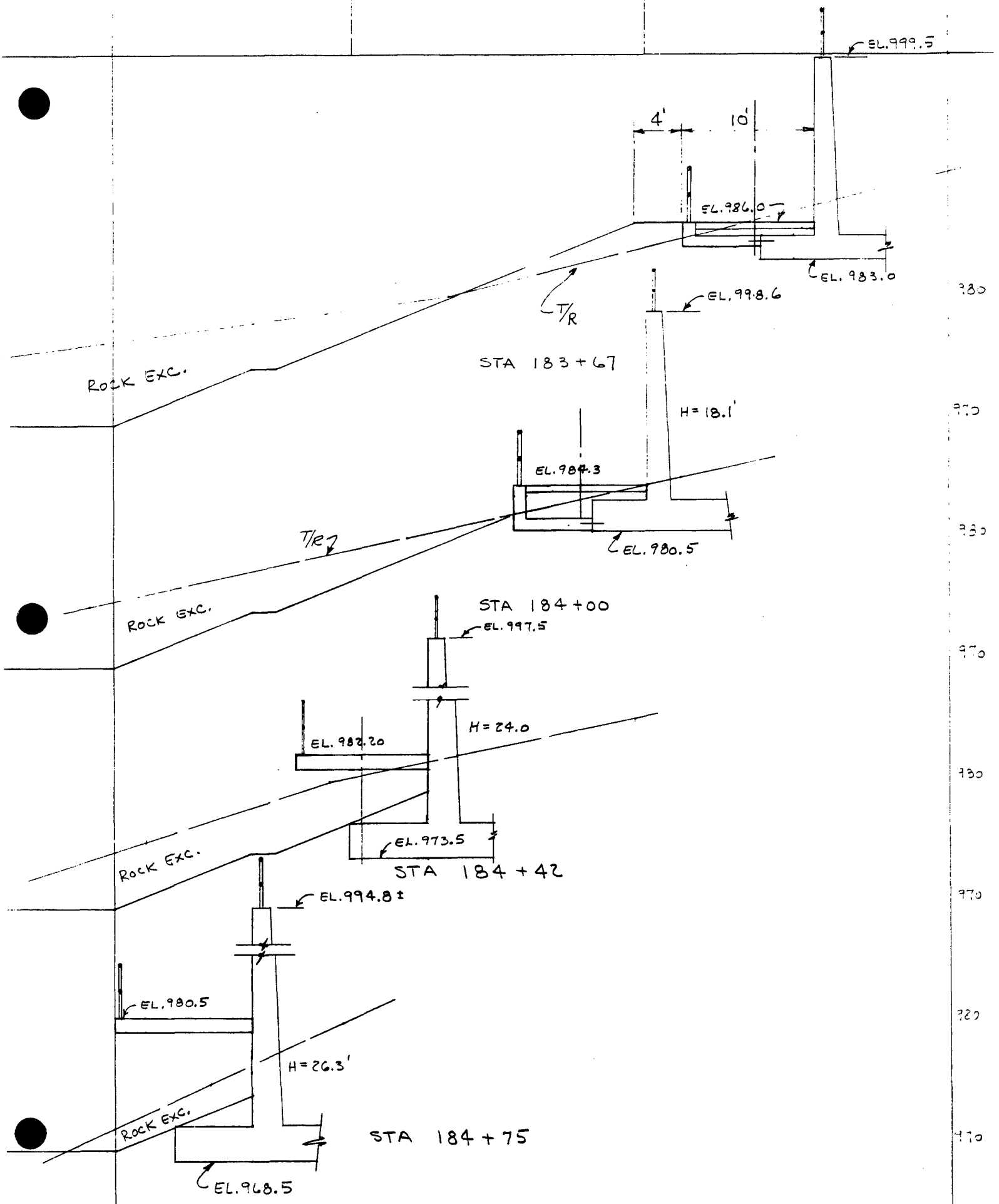


188 + 61.25

ROCHESTER – ZUMBRO RIVER – PHASE B	4283.5	FKD	3/22/88



189+00


EL. 999.5
4'
10'
EL. 986.0
EL. 983.0
T/R
EL. 998.6
ROCK EXC.
STA 183+67
H = 18.1'
EL. 984.3
EL. 980.5
T/R
ROCK EXC.
STA 184+00
EL. 997.5
H = 24.0
EL. 982.20
EL. 973.5
ROCK EXC.
STA 184+42
EL. 994.8 ±
EL. 980.5
H = 26.3'
ROCK EXC.
STA 184+75
EL. 968.5

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B

COMPUTATIONS FOR FLOOD WALLS - LT. BANK
STA. 186+20 TO 202+90

CALCULATIONS FOR FLOOD WALLS

FOR WALLS ON LEFT BANK STA. 186± TO STA. 203±.

FROM FDM NO. 2 STAGE 1B PAGE B-25 USE THE FOLLOWING CRITERIA:

FOR INSITU MATERIAL UNDER FTGS:
(LOWER ALLUVIUM)

$C = 0$
$\phi = 34^\circ$ *
$\gamma_M = 135$ PCF
$\gamma_S = 138$ PCF

SLIDING = TAN ϕ

FOR BACKFILL: (UPPER ALLUVIUM)

$C = 0$
$\phi = 32^\circ$ *
$\gamma_M = 120$ PCF
$\gamma_S = 130$ PCF

* DISCUSSION W/ MARK MYERS COE

FROM EM 1110-2-XXXX SRF = 2/3

$\phi_d = \tan^{-1}[(2/3)(\tan 32^\circ)] = 22.6^\circ$

$K_A = \tan^2(45 - \frac{\phi_d}{2}) = 0.44$

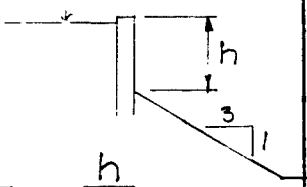
$P_{A(MOIST)} = (120)(.44) = 53$ PCF

ESTIMATE VOIDS @ 25% THEN:

SUBMERGED EARTH = $125 - (.75)(62.4)$
= 78 PCF

EQUIV. FLUID PRESSURE

SUBM. EARTH = (78)(.44)	=	34 PCF
H_2O	=	62 "
TOTAL	=	96 PCF



WALL DIMENSIONS

STA.	TOP ELEV	ELEV. 3:1	h	Str. Bed	Low Water
186+20	985.60	979.6	6.0'	969.62	974.0±
191+00	986.35	980.0	6.4'	970.0	974.0±
193+00	986.67	973.5	13.2'	970.16	974.0±
196+00	987.06	973.7	13.4'	970.36	974.0±
200+00	987.49	981.4	6.1'	970.68	"
203+00	987.67	979.6	8.1'	970.92	"

DESIGN FOR "h" OF 5', 8', 11' & 14'

JOB NO. 4283.5

Wallace Holland Kastler Schmitz & Company
Consulting Engineers & Planners
Mason City, Iowa & Rochester, Minnesota

SHEET 132 OF
MADE CEW DATE 3-8-88
CHECKED EKS DATE 3/

CALCULATIONS FOR ROCHESTER - ZUMBRO
IB

196+00

Area = 72.020'

Σ = 53

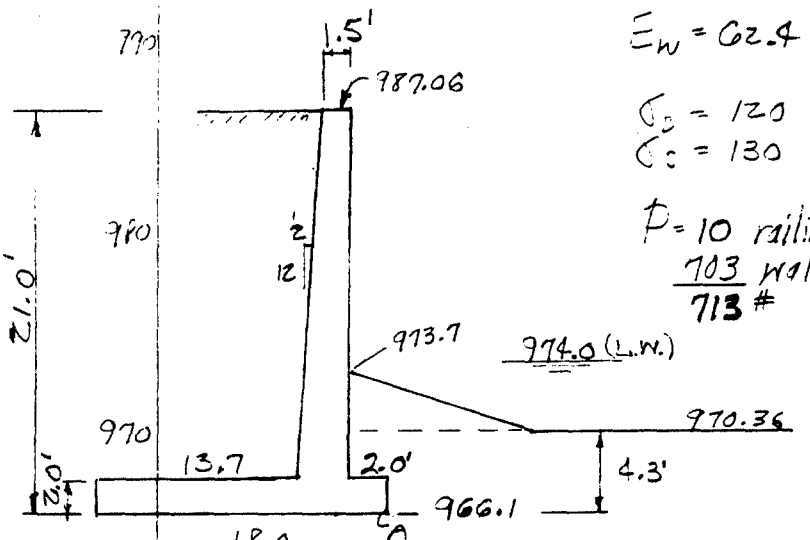
E_s = 34

E_w = 62.4

γ_s = 120

γ_c = 130

P = 10 railing
703 wall
713 #

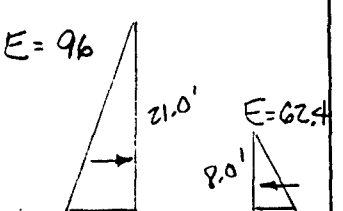


Case I

H = 21 SW = 130
B = 18 E = 96
W = 1.5 S = 0
T = 2.0 P = 10

A = 2.0
C = 2.3
F = .50

R = 6.45
ΣV = 46,248
ΣH = 21,168
ΣM_A = 298,383



Assume backfill will be level to top of wall

ϕ = 0 $\phi_d = \tan^{-1}[(.667 \tan\phi)] = 24.2$

B = 18.0 $K_A = \frac{1-\sin\phi_d}{1+\sin\phi_d} = .42$ $K_p = 2.39$

$\Sigma M_A = 298,383 - 5325 = 293,058$

$R = \frac{293,058}{46,248} = 6.34$

e = 9 − 6.34 = 2.66

$\bar{B} = 18 - 2(2.66) = 12.68$

$\delta = \tan^{-1}\left(\frac{21,168 - 1/2(\quad)}{46,248}\right) = 22.5°$

$\gamma_{Buoy.} = 135 - .75(62.4) = 88$

Case II

H = 8. SW = 0 A = 13.7
B = 18 E = 62.4 C = 0
W = 2.05 S = 0 F = .5
T = 2.0 P = 0
ΣH = 1977

Case IIA

H = 8 SW = 0 A = 2.0
B = 18 E = 0 C = 0
W = 2.05 S = 0 F = .5
T = 2.0 P = 0

Case I Case II

Case IIA - DL Wall

	Heel	Toe
Case I	389	4752
Case II	298	520
Case IIA	-194	-623
Buoy.	-81	-306
	410 psf	4343 psf

D 2.17 T/D'

Bearing Capacity ϕ = 34

N_q = 29.44 Table 5-1

N_γ = 31.15

AASHTO allows 1.4 T/D' for clays and confined sand. Confirm on final design. Say O.K. for feature Design.

C-54

CALCULATIONS FOR ROCHESTER - ZUMBRO IB

Embedment Factor

$$\varepsilon_{qd} = \varepsilon_{\gamma d} = 1.0 + 0.1\left(\frac{D}{B}\right)\tan\left(45 + \frac{\phi}{2}\right)$$

$$= 1.0 + 0.1\left(\frac{4.3}{18}\right)\tan 62$$

$$= 1.04$$

Inclination Factor

$$\varepsilon_{qi} = \left(1 - \frac{\delta}{90}\right)^2$$

$$= \left(1 - \frac{22.5}{90}\right)^2$$

$$= .562$$

$$\varepsilon_{\gamma i} = \left(1 - \frac{\delta}{\phi}\right)^2$$

$$= \left(1 - \frac{22.5}{34}\right)^2$$

$$= .114$$

Base Tilt Factor

$$\varepsilon_{qt} = 1.0 = \varepsilon_{\gamma t}$$

Ground Slope Factor

$$\varepsilon_{qg} = 1.0 = \varepsilon_{\gamma g}$$

Effective Overburden Pressure

$$q_o = \gamma' D = 130(4.3) = 559$$

$$Q = 12.68\left[1.04(.562)(1.0)(1.0)(559)(29.44) + \frac{1.04(.114)(1.0)(1.0)(12.68)(.088)(31.15)}{2}\right]$$

$$= 12.68(9.62 + 2.06)$$

$$= 148.1$$

$$FS = \frac{148.1}{46.25} = 3.2$$

Grade 60 $F_y = 48$

Check for min. d at bott. mat

$M_u = 1.9(109.74) = 208.5^{IK}$ $\phi = .90$

$$e_b = \frac{.85(4)(.85)}{48} \cdot \frac{87}{87+48} = .039$$

$$e_{max} = .039(.25) = .0097$$

$$K_m = \frac{48(.0097)}{.85(4)} = .1369$$

$$d_{min.} = \left[\frac{(208,500)(12)(.9)}{.85(4)(.1369)(12)\left(1 - \frac{.1369}{2}\right)}\right]^{\frac{1}{2}}$$

$$= 23.1$$

$$+ 4.2$$

$D_{min.} = 27.3"$

Rustication = 1.50
½ Bar = 0.69
Cl. = 2.00
4.19

$D = 18 + 9.5$
$= 27.5$ ✓ O.K.

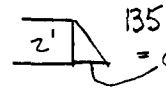
Note ~ Consider 1½" rustication when figuring bar cutoffs for final design

$$\frac{M_u}{bd^2} = \frac{208,500}{25^2} = 333.6$$

$\rho = .00658$ $A_{sn} = 1.97^{D"}/_{1}$

#11 @ 9" o/c
or #10 @ 7½" o/c
or #9 @ 6" o/c

Sliding Stability



$135(2)(2.39)^{KP} = 645$

$$F.S. = \frac{\Sigma V \tan\phi}{P_1 - P_3} = \frac{46,248(.67)}{21,168 - 645(2)(.5)}$$

$= 1.51$ ✓ O.K.

JOB NO. 4283.5

Wallace Holland Kastler Schmitz & Company
Consulting Engineers & Planners
Mason City, Iowa & Rochester, Minnesota

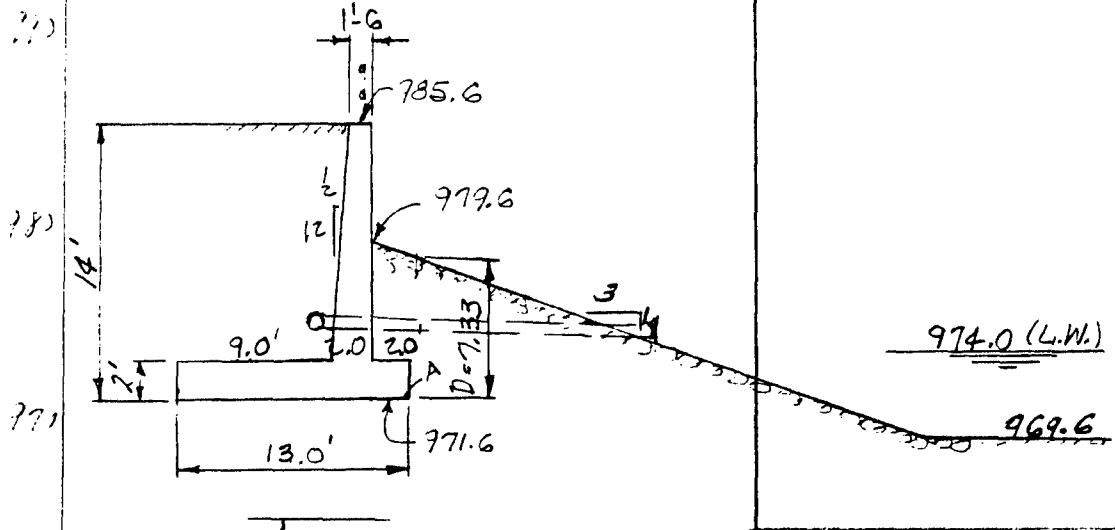
SHEET C-4 OF
MADE CEW DATE 3-7-88
CHECKED FKS DATE 3-2[illegible]

CALCULATIONS FOR ROCHESTER-ZUMBRO IB

186+20

c = 0
K_p = 2.59
$\rho = \tan^{-1}(\frac{1}{3}) = 18.43°$

Area = 47.00 D'



Bott. Sheet Pile Wall to No.

Case I

H = 14	SW = 130	A = 2.0	
B = 13	E = 96	C = 5.7	
H1 = 1.5	S = 0	F = .5	
T = 2.0	P = 10		

	B=12	B=13
Heel =	215	473
Toe =	3303	3061
R =	4.24	4.91
ΣV =	21,112	22,972
ΣH =	9,408	9,408
ΣMA =	89,616	112,865

$e = 6.5 - 4.91 = 1.59$

$\bar{B} = 13.0 - 2(1.59) = 9.82$

$\delta = \tan^{-1}(\frac{9,408}{22,972}) = 22.3$

$\gamma_{Buoy} = 88$

Bearing Capacity $\phi = 34$

$N_q = 29.44$

$N_\gamma = 31.15$

Embedment Factor

$\varepsilon_{qd} = \varepsilon_{\gamma d} = 1.0 + 0.1(\frac{7.33}{13})\tan(45+\frac{\phi}{2})$

$= 1.11$

Inclination Factor

$\varepsilon_{qi} = (1 - \frac{22.3}{90})^2 = .566$

$\varepsilon_{\gamma i} = (1 - \frac{22.3}{34})^2 = .118$

Base Tilt Factor

$\varepsilon_{qt} = \varepsilon_{\gamma t} = 1.0$

CALCULATIONS FOR Rochester-Zumbro IB

Ground Slope Factor

$\varepsilon_{\gamma 2} = \varepsilon_{\gamma 1} = [1 - \tan i]^2$

$= .444$

Effective Overburden Pressure

$q_o = \gamma' D$ @ 18.43

$= 120(7.33)(.95)$

$= 836$

$Q = 9.82\left[1.11(.566)(1.0)(.444)(836)(29.44) + \frac{1.11(.118)(1.0)(.444)(9.82)(.088)(31.15)}{2}\right]$

$= 9.82(6.87 + 0.78)$

$= 75.10$

$F.S. = \frac{59.5}{21.1} = \frac{2.8}{1}$ $B = 12'$

$\frac{75.1}{23.0} = \frac{3.26}{1}$ $B = 13'$

Sliding Stability

$F.S. = \frac{\Sigma V \tan\phi}{P_1 - P_3} = \frac{23.0(.67)}{9.08 - .645(2)(.5)}$

$= \frac{1.76}{1} > 1.5$ O.K.

Check for min. d at ext. wall

$M_u = 1.9(27,678) = 52,531$ $\phi = .7$

$e_b = .039$ $e_{max} = .0377$

$K_m = .1369$

$d_{min.} = \left[\frac{52.53(12)/.9}{.85(4)(.1369)(12)(1 - \frac{.1369}{2})}\right]^{\frac{1}{2}}$

$= 11.6$

2.7

$D_{min.} = 14.3$ $D = 24.0$ O.K.

JOB NO. 4283.5

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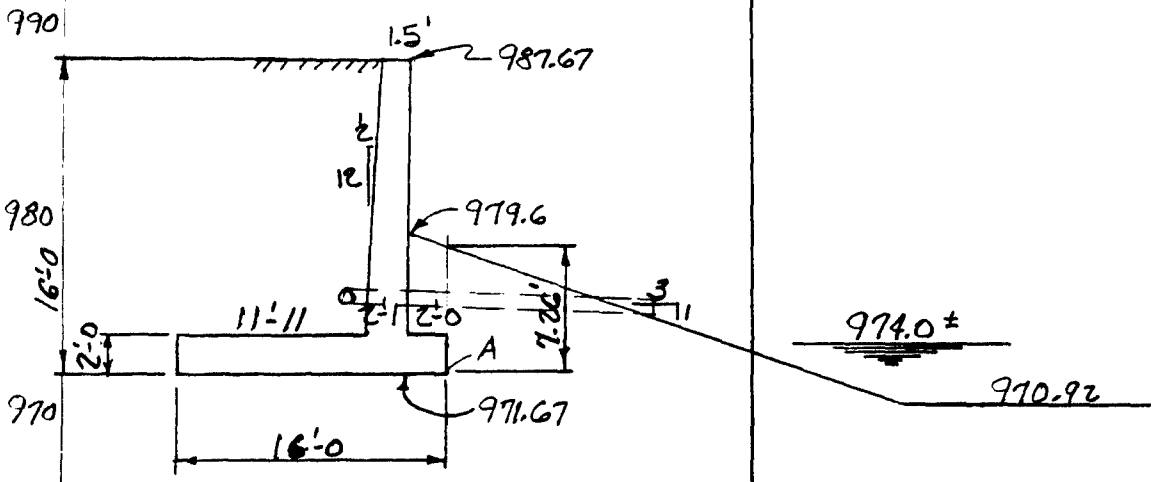
Mason City, Iowa & Rochester, Minnesota

SHEET CC6 OF
MADE CEW DATE 3-7-88
CHECKED FK DATE 3/[illegible]

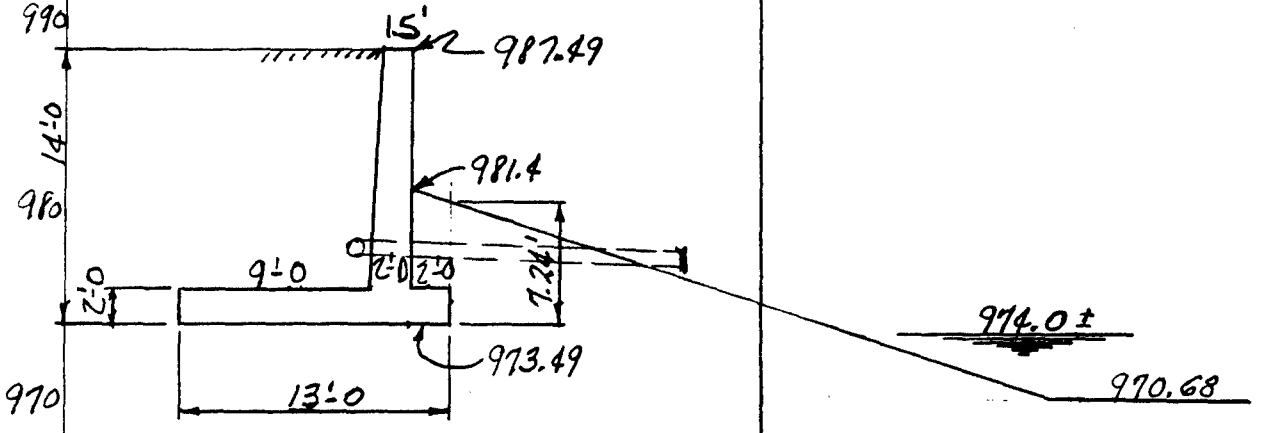
CALCULATIONS FOR ROCHESTER-ZUMBRO IB

203+00

Area = 57.08 □'

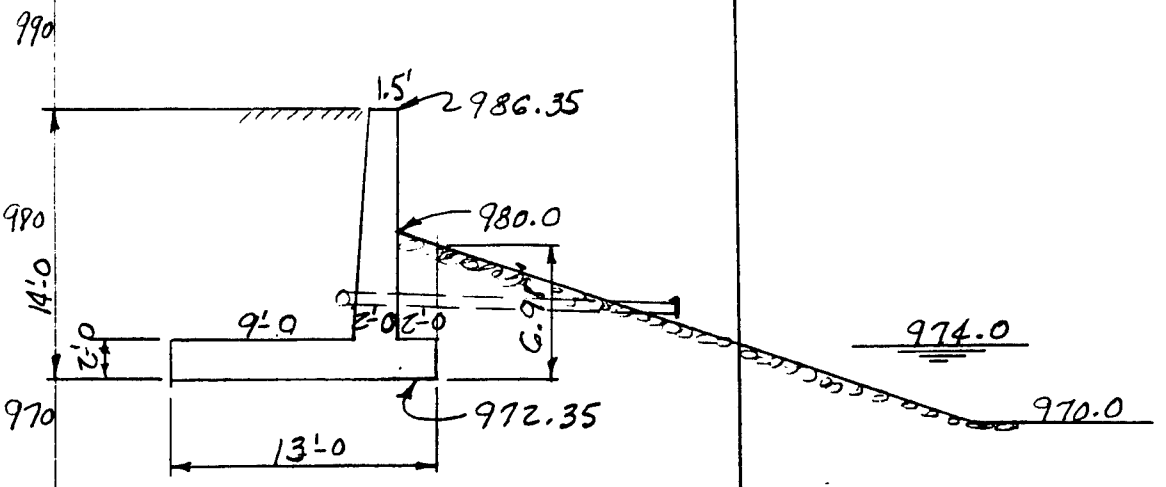


200+00

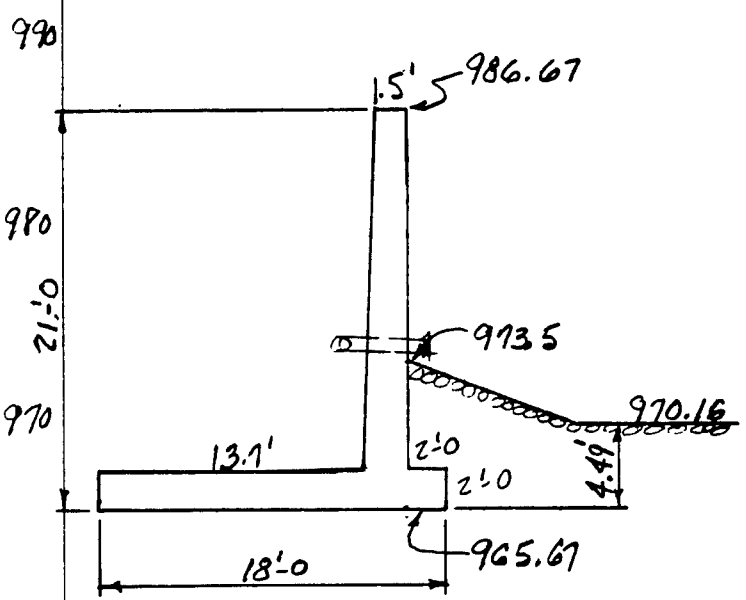


CALCULATIONS FOR ROCHESTER - ZUMBRO IB

191+00



193+00



CALCULATIONS FOR ROCHESTER ZUMBRO
1B

203+00

Case 1

$H = 16$ $JW = 130$ $A = 2.0$
$B = 15$ $E = 96$ $C = 5.6$
$N = 1.5$ $S = 0$ $F = .5$
$T = 2.0$ $P = 10$

	B=15	B=16
Heel =	577	777
Toe =	3440	3254
$\bar{x}$ =	5.72	6.36
ΣV =	30,128	32,248
ΣH =	12,288	12,288
ΣM_A =	172,764	205,124

	B=15'	B=16'
$e = 7.5 - 5.72 = 1.78$		1.64
$\bar{B} = 15.0 - 2(1.78) = 11.44$		12.7
$\theta = \tan^{-1}(\frac{12,288}{30,128}) = 22.2$		20.9

$\gamma_{Buoy.} = 88$

Bearing Capacity

$\phi = 34$

$N_q = 29.44$

$N_\gamma = 31.15$

Embedment Factor

$\varepsilon_{qd} = \varepsilon_{\gamma d} = 1.0 + 0.1(\frac{7.76}{15})\tan(45 + \frac{\phi}{2})$

$= 1.09$ B=15'

1.09 B=16'

Inclination Factor

	B=15'	B=16'
$\varepsilon_{qi} = (1 - \frac{22.2}{90})^2$	.568	.589
$\varepsilon_{\gamma i} = (1 - \frac{22.2}{34})^2$	.120	.148

Base Tilt Factor

$\varepsilon_{qt} = \varepsilon_{\gamma t} = 1.0$

Ground Slope Factor

$\varepsilon_{qg} = \varepsilon_{\gamma g} = [1 - \tan\beta]^2$

$= .444$

Effective Overburden Press.

$q_0 = 120(7.26)\cos 18.43$
$= 120(7.26)(.95)$
$= 826$

$Q = 11.44[1.09(.568)(1.0)(.444)(.826)(29.44)$
$+ \frac{1.09(.120)(1.0)(.444)(11.44)(.088)(31.15)}{2}]$

$= 11.44(6.68 + 0.91)$ $12.7(6.93 + 1.25)$
$= 86.8$ $= 103.9$
B=1 B=16'

F.S. $= \frac{86.8}{30.1} = 2.88$ B=15'

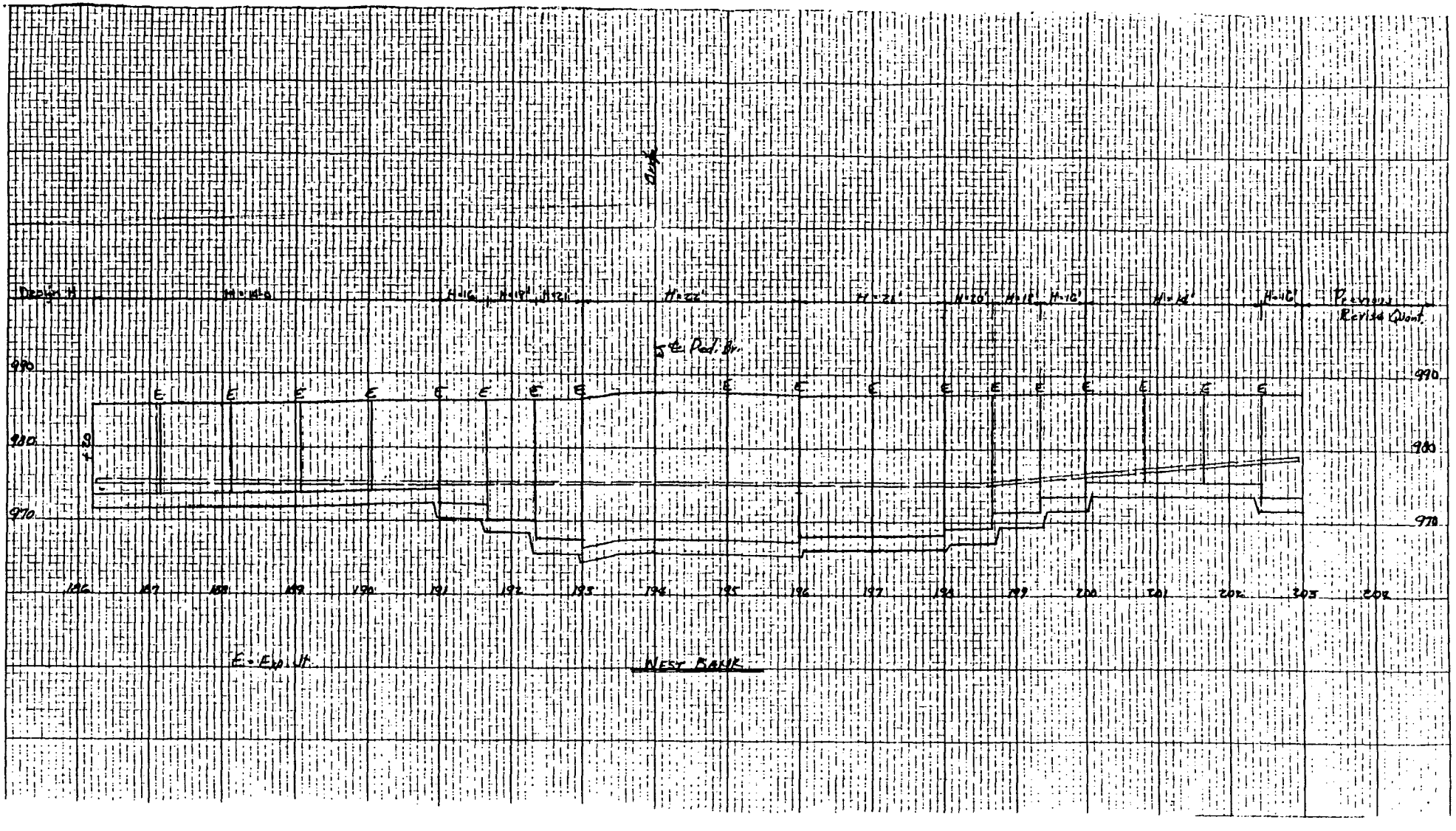
$\frac{103.9}{32.3} = \frac{3.2}{1}$ B=16'

Sliding

F.S. $= \frac{\Sigma V \tan\phi}{P_1 - P_3} = \frac{32248(.67)}{12,288 - 645(2)(.5)}$

$= \frac{1.85}{1} > 1.5$ O.K.

C-60


Design H
H=16'-0
H=16'
H=18'
H=12'
H=22'
H=24'
H=20'
H=18'
H=16'
H=14'
H=16'
Previous Revised Quant.
Ped. Br.
990
980
970
E
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
E.=Exp. Jt.
WEST BANK

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B

COMPUTATIONS FOR BIKEWAY AND PEDESTRIAN BRIDGE
STA. 194+00

JOB NO. 4283.5

Wallace Holland Kastler Schmitz & Company
Consulting Engineers & Planners
Mason City, Iowa & Rochester, Minnesota

SHEET B1 OF
MADE CEW DATE 3-24-88
CHECKED DATE

CALCULATIONS FOR ROCHESTER-ZUMBRO

IB - Sta. 194+00

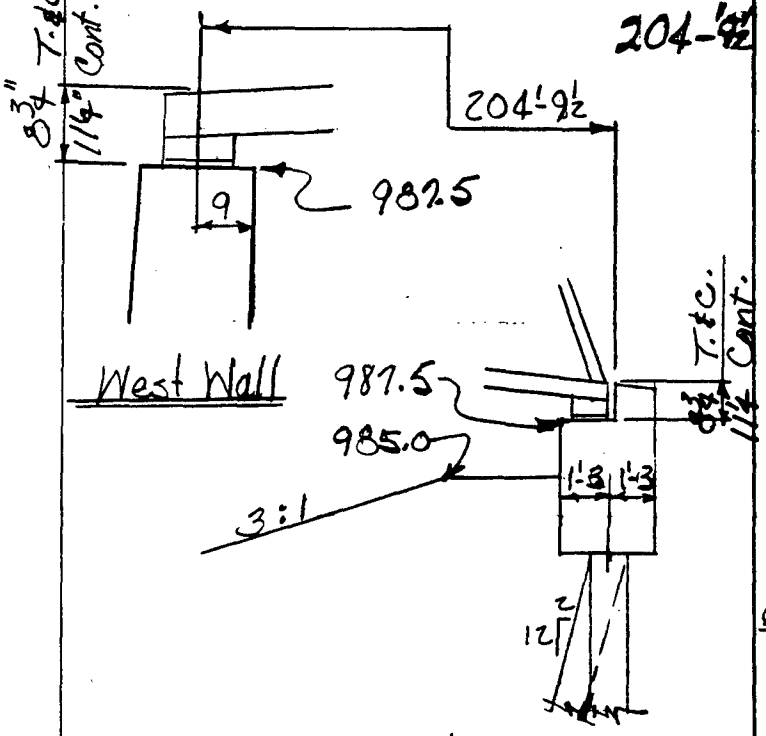
PEDESTRIAN BRIDGE STA 194

Per Memo 3-3-88 / Dave T.

Use 3' freeboard at middle of bridge and clear DHW at ends of bridge.

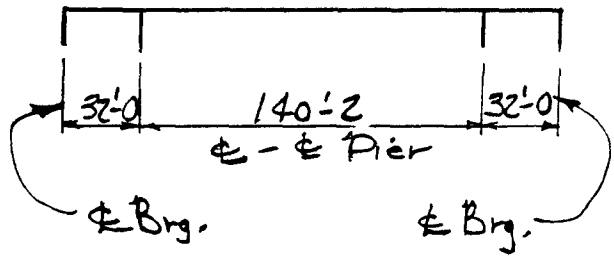
Max. Grade for handicapped is 8.3%

℄ to Face Wall	= 0'-9
Face Wall to toe slope	= 155'-0
(985 - 990.2)(3)	= 44'-5
Berm	= 3'-4½
One Half Ftg.	= 1'-3
	204'-9½



G-63

Normal bridge camber
= 2½% x Span
140 x .025 = 3.5'
Bridge will accomodate 1% - 7% camber



204-9½
0-7½ ℄ Abut. to ℄ Brg.
204-2
140-2
64-0 Try 210' V.C.

M.O. = $\frac{(8.3+8.3)}{8}\left(\frac{210}{100}\right)$ = 4.36'

Permanent Camber

Center Span

$\frac{140.17^2}{21.0^2}(4.36)$ = 1.94'

Bridge

$\frac{204.17^2}{21.0^2}(4.36)$ = 4.12'

℄ Grade = 987.50 + 1.00 + 4.12
= 992.62

Clearance at Piers

Grade at ℄	= 992.62
	- 1.94
Grade at Piers	= 990.68
Assume to Low Pt.	= - 1.00
Low Pt. Super.	= 989.68
DWS (200 yr.)	= 986.79
Clear.	2.89'

CALCULATIONS FOR ROCHESTER-ZUMBRO

IB - Pedestrian Bridge

Clearance at ℄ Bridge

992.62
− 1.00
991.62 Low Pt.
986.79 DNS
4.83' Clear.

Clearance at Abutments

987.50
986.79
0.71' Min. Cl.

Front Face Backwall = 988.45
Back Face Backwall = 988.28

+8.3% ——— −8.3%

P.I. Sta. 5+00
El. 996.98
a = 3.95238 V.C. = 210'

PIERS

10' Clear Width on Bridge Truss

		Reaction 140'	Reaction 32'
D.L.	(45.0 ~ 8.2).5	22.5K	4.4K
L.L.	@ 60 psf	42.0K	9.6K

Wind on Super. 60% As for open truss

$W_t = .05(.6)(86)(7) = 18.1^K$

$W_l = .012(.6)(86)(7) = 4.3^K$

70 / 1.6 / 86

Wind on Substructure

40#/□'

Wind Overturning Force

20#/□' at ↳ Pt.
.020(86)(12) = 20.6K ↑

Temperature Movements

Steel Structure −15°F change
$\Delta_{140} = 70(12)(75)(6.5\times10^{-6}) = .41"$

CALCULATIONS FOR ROCHESTER - ZUMBRO
IB

$\Delta = \frac{Pl^3}{3EI}$ $\quad I = \frac{144(36)^3}{12} + \frac{\pi(18)^4}{4}$

$= 642,320$

$P = \frac{3(3,372)(642,320)(.41)}{(276)^3}$

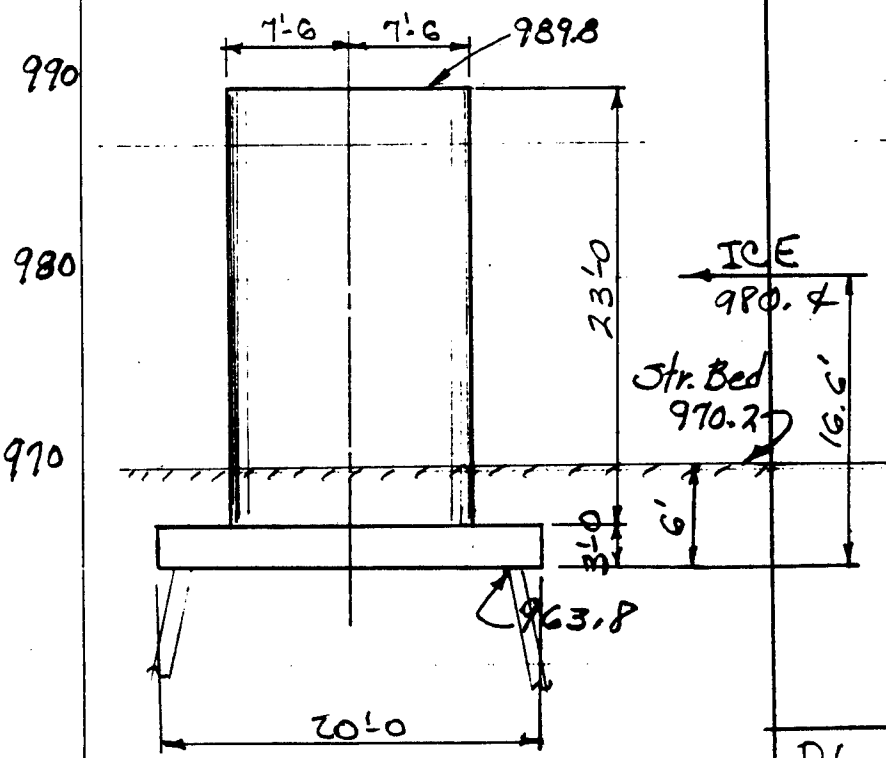
$= 126.7^K$

Friction = $(22.5 - 4.4)(.25)$ DL
$= 4.5^K$

Stream Flow

Say,

$P = KV^2 = 0.67(8)^2 = 43\#/\square'$



ICE - AASHTO

$F = C_h p t w (.9)$

$= 1.0(300)(12)(36)(.9)$

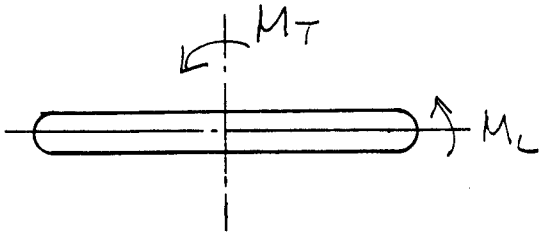
$= 116.6^K$ T $\quad 17.5^K$ L

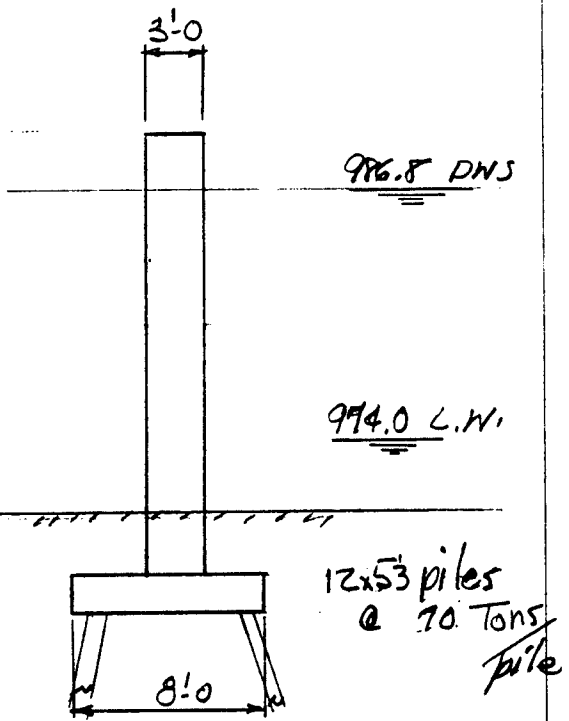
Shaft A = 43.1 □'

C-65

83-56M - 300' Downstream
No rock shown to elev. 958.0

84-74M - 120' SW of W. Abut.
No rock shown to elev. 958.6





DL. Pier

Top to ICE $43.1(9.4)(.15) = 60.8^K$

Top to LW $43.1(15.8)(.15) = 102.1^K$

ICE to Ftg. $43.1(13.6)(\ell) = 87.9^K$

LW to Ftg. $(43.1)(7.2)(\ell) = 46.5^K$

Shaft total $= 148.7^K$

Ftg. $\ell o(8)(3)(.15) = 72.0^K$

JOB NO. 4283.5

Wallace Holland Kastler Schmitz & Company
Consulting Engineers & Planners
Mason City, Iowa & Rochester, Minnesota

SHEET B4 OF
MADE CEW DATE 3-25-88
CHECKED DATE

CALCULATIONS FOR ROCHESTER-ZUMBRO
IB

Buoyancy

ICE $(87.9+72.0)\frac{62.4}{150} = 66.5^K$ ↑

L.W. $(46.5+72.0)\frac{62.4}{150} = 49.3^K$ ↑

Earth

$= 3.4(160-43.1)(.013) = 29.0^K$

Grp. I D+L+E+B+SF @100%

		P
DL Super	22.5+4.4	= 26.9
LL	42.0+9.6	= 51.6
Earth		= 29.0
DL Pier	148.7+72.0	= 220.7
B LW		= -49.3
		278.9^K

SF_{LW} $0.5(4.9) = 2.5^K$ M_T

M_L = DL $(22.5-4.4)(.6) = 10.9$
LL $(42.0-9.6)(.6) = 19.4$
30.3^{IK}

Stream Flow

ICE $13.6(3)(.043) = 1.8^K$ @ 6.8^K B.F.

LW $3.8(3)(.043) = 0.5^K$ @ 4.9' B.F.

Grp. II D+E+B+SF+W @125%

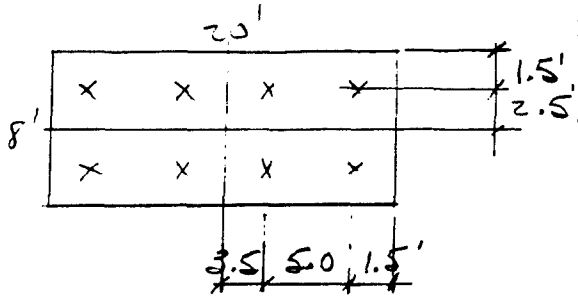
	P	H	arm	M_T	M_L
DLS	26.9	—		—	11
DLP	220.7	—	—	—	—
E	29.0	—	—	—	—
B	-49.3	—	—	—	—
SF	—	0.5	4.9	3	—
W_t	—	18.1	26.0	471	—
W_e	—	4.3	27.0	—	116
NAT.	-20.6	—	3.0	62	—
W.O.S.	—	11.8	16.2	—	191
125%	207^K			536^{IK}	318^{IK}
100%	166^K			429^{IK}	254^{IK}

Grp IV D+E+B+SF+W+ICE @150%

	P	H	arm	M_T	M_L
DLS	27			—	11
DLP	221			—	—
E	29			—	—
B pier	67			—	—
SF		1.8	6.8	12	—
W	-21			533	236
ICE		117	16.6	1942	—
		18	16.6	—	299
150%	189			2487	546
100%	126^K			1658^{IK}	364^{IK}

C-66

CALCULATIONS FOR ROCHESTER ZUMBRO



$S_L = 8(2.5)^2 \div 2.5 = 20.0$

$S_T = 4(3.5)^2 + 4(8.5)^2 \div 1.5 = 39.7$

Grp I

$P = \frac{278.9}{8} \pm \frac{2.5}{39.7} \pm \frac{30.3}{20}$

$= 34.9 \pm 0.1 \pm 1.5 = 36.5$ max.
33.3 min.

Grp. II

$P = \frac{166}{8} \pm \frac{429}{39.7} \pm \frac{254}{20}$

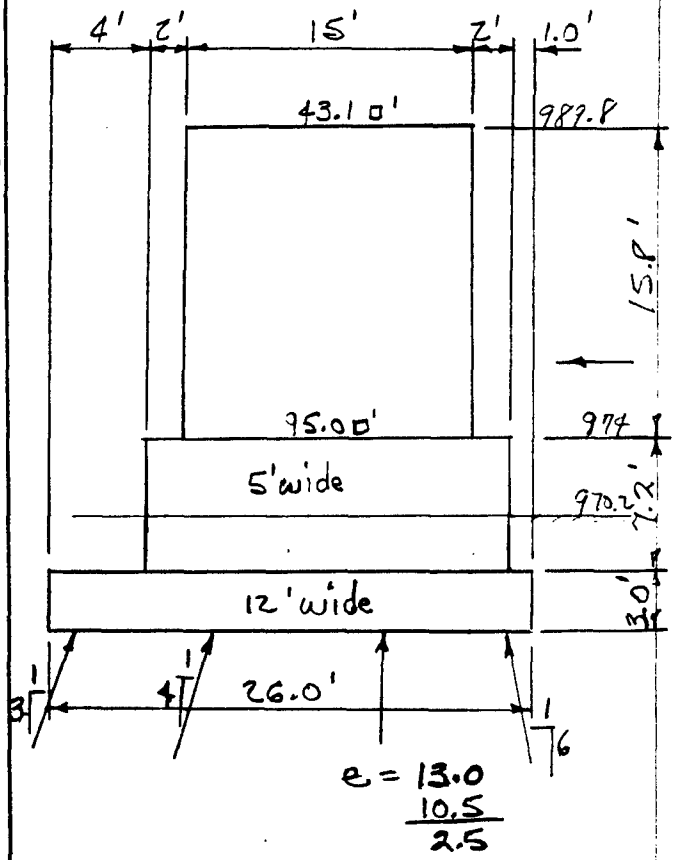
$= 20.8 \pm 10.8 \pm 12.7 = 44.3$ max.
-2.7 min

Grp. IX

$P = \frac{126}{8} \pm \frac{1658}{39.7} \pm \frac{364}{20}$

$= 15.8 \pm 41.8 \pm 18.2 = 75.8$ max.
-44.2

Try for no uplift on piling



e = 13.0
10.5
2.5

D.L. Pier

Top to ICE $43.1(9.4)(.15) = 60.8^K$

Top to LW $43.1(15.8)(\frac{1}{2}) = 102.1^K$

LW to Ftg. $95.0(7.2)(\frac{1}{2}) = 102.6^K$

ICE to Ftg $(204.7 - 60.8) = 143.9^K$

Shaft Total $= 204.7^K$

Ftg. $26(3)(12)(.15) = 140.4^K$

Buoyancy

ICE $(143.9 + 140.4)\frac{62.4}{150} = 118.3^K\uparrow$

LW $(102.6 + 140.4)\frac{1}{2} = 101.1^K\uparrow$

Earth $(312.0 - 95.0)(3.4)(.073) = 53.9^K\downarrow$

C-67

JOB NO. 4283.5

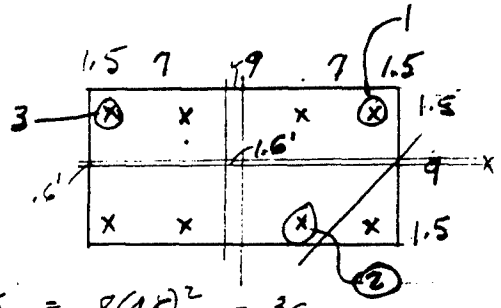
Wallace Holland Kastler Schmitz & Company
Consulting Engineers & Planners
Mason City, Iowa & Rochester, Minnesota

SHEET BG OF
MADE CEW DATE 4-7-88
CHECKED DATE

CALCULATIONS FOR ROCHESTER - ZUMBRO

Grp. IV D+E+B+SF+ICE+W @150%

	P	L	arm	M_T	M_L
DLS	27		-2.5	-68	11
DLP	205		-2.5	-512	—
	140		—	—	—
E	54		1.1	59	—
B	60↑		2.5	150	—
	58↑		—	—	—
SF		1.8T	6.8	12	—
W	21↑			533	236
ICE		11T		1942	—
		18L		—	299
@150%	287K			2116IK	546IK
@100%	191K			1411IK	364IK
			c.g.	7.4	1.9



$I_L = \frac{8(4.5)^2}{4.5} = 36$

$I_T = 4(4.5)^2 + 4(11.5)^2 \div 11.5 = 53.0$

$P = \frac{191}{8} \pm \frac{1411}{53} \pm \frac{364}{36}$

$= 23.9 \pm 26.6 \pm 10.1 = 60.6^K$ max.
-12.8^K min.
$+7.4^K$ min.

$P_3 = \frac{191}{7} + \frac{1108(9.9)}{459} + \frac{248(3.9)}{139}$

$= 27.3 + 23.9 + 7.0 = 58.2^K$

Check stress with overloaded pile out

cg T

2(1.5)		
2(8.5)		
2(17.5)		
1(24.5)		
7	79.5	13.0
		11.4
		1.6

cg L

4(1.5)		
3(10.5)		
7	37.5	6.0
		5.4
		0.6

P	e	M_T	M_L
191K	(7.4-1.6)	1108IK	—
	(1.9-.6)	—	248IK

$I_T = 2(9.9)^2 = 196$
$2(2.9)^2 = 17$
$2(6.1)^2 = 74$
$1(13.1)^2 = 172$
459

$I_L = 4(3.9)^2 = 60.8$
$3(5.1)^2 = 78.0$
138.8

$P_1 = \frac{191}{7} - \frac{1108(13.1)}{459} + \frac{248(3.9)}{139}$

$= 27.3 - 31.6 + 7.0 = +2.7^K$

$P_2 = \frac{191}{7} - \frac{1108(6.1)}{459} - \frac{248(5.1)}{139}$

$= 27.3 - 14.7 - 9.1 = +3.5^K$

G-68
G-54

CALCULATIONS FOR ROCHESTER - ZUMBRO

Check Pile Shear

$H = \frac{117 + 2}{1.5} = 79$

Batter $\frac{51.2}{3}(2) = -34$

$\frac{45}{8} = 5.6$ K/pile

Batter Second Row

$\frac{191}{7} + \frac{1108(2.9)}{459} = 27.3 + 7.0$

$= 34.3$

$34.3(2) = \frac{79.0 - 34.0 - 17.0}{4}$

$\frac{28.0}{8} = 3.5$ K/pile

< 4 K/pile

Say O.K.

Use Pier Shown on Sh. B5

West Abutment

Set bridge on flood wall

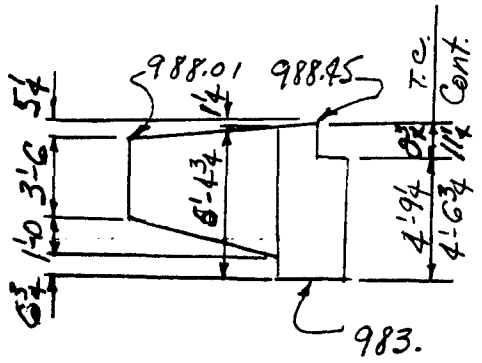
DL Super 4.4 p. B4
LL 7.6 "
14.0 K

Spread over (12 + 18 + 18) 48'

$\frac{14}{48} = .29$ K/1 = 290 #/1 of wall

East Abutment

Use same design as Stage 1A-2



C-69
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APPENDIX D

COST ESTIMATE

SUMMARY OF ESTIMATED FIRST COST
(October 1988 Price Levels)
for
Rochester Stage 1B
Supplement to Feature Design Memorandum

Project First Costs		
Utility Relocation *		185,040.00
Channel *		9,707,440.00
Recreation Facilities *		1,300,700.00
LERRDS		924,200.00
Lands **	570,000.00	
Relocations *	354,200.00	
Engineering & Design *		2,227,470.00
Recreation Facilities	156,080.00	
Other	2,071,390.00	
Supervision & Administration *		918,040.00
Recreation Facilities	88,770.00	
Other	829,270.00	
TOTAL PROJECT FIRST COSTS.....		$15,262,890.00
Non-Federal First Costs ***		
Recreation Facilities		772,780.00
Flood Control Costs		3,429,335.00
Cash Contribution	3,277,915.00	-NA-
TOTAL NON-FEDERAL FIRST COSTS..... (Not Including Betterments)		$ 4,202,115.00
TOTAL ESTIMATED FEDERAL FIRST COST.....		$11,060,775.00
Non-Federal First Costs (Not Included in Federal First Cost) *		
Betterments		$ 1,653,630.00

* December 1986 Price x (1.0607) = October 1988 Price. Based on following ENR CC Indexes: Oct 1988 @ 4615 (Projected) & Dec 1986 @ 4351 (Actual).
** No change from Dec 1986 price.
*** Costs recomputed.

SUMMARY OF ESTIMATED FIRST COST
(December 1986 Price Levels)
for
Rochester Stage 1B
Supplement to Feature Design Memorandum

Project First Costs

	Page (D-)		
Utility Relocation	(1)		174,450.00
Channel	(15)		9,151,920.00
Recreation Facilities	(22)		1,226,270.00
LERRDS	(25)		903,900.00
Lands	(23)	570,000.00	
Relocations	(25)	333,900.00	
Engineering & Design			2,100,000.00
Recreation Facilities	(22)	147,152.00	
Other	(25)	1,952,848.00	
Supervision & Administration			865,500.00
Recreation Facilities	(22)	83,693.00	
Other	(25)	781,807.00	
TOTAL PROJECT FIRST COSTS.....			$14,422,040.00

Non-Federal First Costs

Recreation Facilities	(26)		728,557.50
Flood Control Costs	(26)		3,241,231.25
Cash Contribution	(26)	3,065,888.75	-NA-
TOTAL NON-FEDERAL FIRST COSTS..... (Not Including Betterments)			$ 3,969,788.75
TOTAL ESTIMATED FEDERAL FIRST COST.....			$10,452,251.25

Non-Federal First Costs
(Not Included in Federal First Cost)

Betterments	(28)	$ 1,559,000.00

APPENDIX D

DETAILED ESTIMATE OF FIRST COST
(December 1986 Price Levels)

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
2.7 Utility Relocation				
8" & 10" Sanitary Sewer Inverted Siphons, Sta. 156+30				
Remove 8" and 10" CIP Inverted Siphons	Job	Sum	***	5,500.00
Trench Excavation	CY	6,825	5.00	34,125.00
Backfill	CY	4,988	3.00	14,964.00
Backfill, Granular	CY	2,988	6.50	19,422.00
8" DIP w/Mechanical Joint	LF	120	18.00	2,160.00
10" DIP w/Mechanical Joint	LF	120	20.00	2,400.00
8" DIP w/Ball Joint, River Crossing	LF	325	105.00	34,125.00
10" DIP w/Ball Joint, River Crossing	LF	325	120.00	39,000.00
Contingencies	15 percent			22,754.00
Total 2.7 Utility Relocation				$174,450.00
9 Channel				
Preliminary Work				
Preparation of Disposal Areas	Job	Sum	***	20,000.00
Clearing and Grubbing in Disposal Areas	Acre	2	2,000.00	4,000.00
Preparation for Seeding	Job	Sum	***	8,000.00
Seeding, Fertilizing,& Mulching in Disposal Areas	Acre	10	700.00	7,000.00
Landscaping in Disposal Areas	Job	Sum	***	10,000.00
Contingencies	15 Percent			7,350.00
Total Preliminary Work				$56,350.00
Bridge Scour Protections				
N. Broadway Bridge, Sta. 125+60				
Excavation, Common	CY	1,120	3.00	3,360.00
Gabions, Type A	CY	784	85.00	66,640.00
Bedding for Gabions	CY	233	12.50	2,912.50
Concrete Protection				
Concrete	CY	103	170.00	17,510.00
Reinforcing Steel	Lbs	14,486	0.40	5,794.40
Cement	Cwt	735	5.00	3,675.00
Drilling for Dowels	LF	188	3.00	564.00
Dowels	Lbs	563	2.00	1,126.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Bridge Scour Protections (Cont'd)				
7th Str. NE Bridge, Sta. 157+00				
Excavation, Common	CY	3,735	3.00	11,205.00
Riprap, Type B	CY	2,012	21.00	42,252.00
Bedding for Riprap	CY	1,150	12.50	14,375.00
Concrete Protection				
Concrete	CY	574	170.00	97,580.00
Reinforcing Steel	Lbs	80,423	0.40	32,169.20
Cement	Cwt	4,079	5.00	20,395.00
Drilling for Dowels	LF	176	3.00	528.00
Dowels	Lbs	527	2.00	1,054.00
Dakota, Minnesota, & Eastern Railroad Bridge, Sta. 174+25				
Excavation, Common	CY	2,113	3.00	6,339.00
Gabions, Type A	CY	1,284	85.00	109,140.00
Bedding for Gabions	CY	548	12.50	6,850.00
Concrete Protection				
Concrete	CY	281	170.00	47,770.00
Reinforcing Steel	Lbs	39,358	0.40	15,743.20
Cement	Cwt	1,996	5.00	9,980.00
Drilling for Dowels	LF	206	3.00	618.00
Dowels	Lbs	596	2.00	1,192.00
Center Street Bridge, Sta. 184+80				
Excavation, Common	CY	2,700	3.00	8,100.00
Excavation, Rock	CY	282	10.00	2,820.00
Gabions, Type A	CY	1,719	85.00	146,115.00
Bedding for Gabions	CY	759	12.50	9,487.50
Concrete Protection				
Concrete	CY	503	170.00	85,510.00
Reinforcing Steel	Lbs	70,434	0.40	28,173.60
Cement	Cwt	3,572	5.00	17,860.00
Drilling for Dowels & Rock Anchors	LF	438	3.00	1,314.00
Dowels	Lbs	714	2.00	1,428.00
40K Double Erosion Protection Rock Anchors	Lbs	490	3.00	1,470.00
3rd Avenue SE Bridge, Sta. 205+67				
Excavation, Common	CY	1,548	3.00	4,644.00
Riprap, Type B	CY	1,032	21.00	21,672.00
Bedding for Riprap	CY	516	12.50	6,450.00
4th Street SE Bridge, Sta. 6+55				
Excavation, Common	CY	1,890	3.00	5,670.00
Gabions, Type A	CY	1,260	85.00	107,100.00
Bedding for Gabions	CY	630	12.50	7,875.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Bridge Scour Protections (Cont'd)				
Dewatering	Job	Sum	***	104,000.00
Contingencies	~15 Percent			161,538.60
Total Bridge Scour Protections.....				$1,240,000.00
Flood and Wing Walls				
Concrete Flood Wall, Sta. 125+73 to Sta. 126+58 Rt. Bank				
Foundation Work				
Clearing and Grubbing	Acre	0.1	2,000.00	200.00
Stripping	CY	28	2.00	56.00
Excavation, Structure	CY	2,759	6.00	16,554.00
Backfill	CY	3,090	3.00	9,270.00
Wall Construction				
Concrete	CY	289	170.00	49,130.00
Reinforcing Steel	Lbs	43,350	0.40	17,340.00
Cement	Cwt	2,052	5.00	10,260.00
Joint Filler	LF	15	2.00	30.00
Concrete Slope Paving				
Concrete	CY	117	115.00	13,455.00
Cement	Cwt	827	5.00	4,135.00
Joint Filler	LF	200	2.00	400.00
Topsoil	CY	25	6.00	150.00
Sod	SY	590	1.30	767.00
Concrete Flood Wall, Sta. 126+23 to Sta. 126+50 Lt. Bank				
Foundation Work				
Stripping	CY	30	2.00	60.00
Excavation, Structure	CY	1,520	6.00	9,120.00
Backfill	CY	1,570	3.00	4,710.00
Wall Construction				
Concrete	CY	223	170.00	37,910.00
Reinforcing Steel	Lbs	33,500	0.40	13,400.00
Cement	Cwt	1,583	5.00	7,915.00
Remove and Reinstall Pipe Rail	LF	22	6.00	132.00
Remove Rail and Replace with Chainlink Fence	LF	26	10.00	260.00
Concrete Slope Paving				
Concrete	CY	42	115.00	4,830.00
Cement	Cwt	298	5.00	1,490.00
Joint Filler	LF	160	2.00	320.00
Topsoil	CY	31	6.00	186.00
Sod	SY	190	1.30	247.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Flood and Wing Walls				
Concrete Flood Wall, Sta. 169+40 to Sta. 174+79 Rt. Bank				
Foundation Work				
Stripping	CY	206	2.00	412.00
Excavation, Structure	CY	3,041	6.00	18,246.00
Excavation, Rock	CY	1,402	25.00	35,050.00
Backfill	CY	5,897	3.00	17,691.00
Backfill, Granular	CY	620	9.00	5,580.00
Wall Construction				
Concrete	CY	1,064	170.00	180,880.00
Reinforcing Steel	Lbs	171,800	0.40	68,720.00
Cement	Cwt	7,555	5.00	37,775.00
Joint Filler	LF	120	2.00	240.00
Handrail, Type B	LF	460	70.00	32,200.00
Wall Toe Drain				
8" Perforated CMP	LF	475	9.00	4,275.00
Flap Gates for 8" CMP	Each	5	160.00	800.00
Storm Sewer Outlet				
Catch Basin	Each	1	1,000.00	1,000.00
24" RCP	LF	10	29.00	290.00
Flap Gate for 24" RCP	Each	1	450.00	450.00
Landscaping	Job	Sum	***	7,436.00
Concrete Wing Wall, Sta. 185+93 to Sta. 186+53 Rt. Bank				
Foundation Work				
Stripping	CY	39	2.00	78.00
Excavation, Structure	CY	502	6.00	3,012.00
Excavation, Rock	CY	140	25.00	3,500.00
Backfill	CY	585	3.00	1,755.00
Backfill, Granular	CY	43	9.00	387.00
Wall Construction				
Concrete	CY	162	170.00	27,540.00
Reinforcing Steel	Lbs	24,300	0.40	9,720.00
Cement	Cwt	1,150	5.00	5,750.00
Handrail, Type E	LF	63	30.00	1,890.00
Wall Toe Drain				
8" Perforated CMP	LF	104	9.00	936.00
Flap Gate for 8" CMP	Each	1	160.00	160.00
Topsoil	CY	26	6.00	156.00
Sod	SY	233	1.30	302.90
Landscaping	Job	Sum	***	1,000.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Flood and Wing Walls				
Concrete Flood Wall, Sta. 202+90 to Sta. 204+97 Lt. Bank				
Foundation Work				
Stripping	CY	204	2.00	408.00
Excavation, Structure	CY	6,064	6.00	36,384.00
Backfill	CY	6,423	3.00	19,269.00
Backfill, Granular	CY	339	9.00	3,051.00
Piles, HP 10 x 42	Each	105	800.00	84,000.00
Wall Construction				
Concrete	CY	764	170.00	129,880.00
Reinforcing Steel	Lbs	114,600	0.40	45,840.00
Cement	LF	5,424	5.00	27,120.00
Joint Filler	LF	40	2.00	80.00
Handrail, Type B	LF	250	70.00	17,500.00
Wall Toe Drain				
8" Perforated CMP	LF	250	9.00	2,250.00
Flap Gate for 8" CMP	Each	2	160.00	320.00
Topsoil	CY	134	6.00	804.00
Sod	SY	1,222	1.30	1,588.00
Sheet Pile Wing Walls at 7th Street NE Bridge, Sta. 157+00				
Wall Construction				
PZ-22 Sheet Pile	SF	149	16.00	2,384.00
PZ-27 Sheet Pile	SF	3,796	16.00	60,736.00
Concrete Cap				
Excavation, Structure	CY	66	6.00	396.00
Backfill	CY	53	3.00	159.00
Concrete	CY	25	265.00	6,625.00
Reinforcing Steel	Lbs	2,000	0.40	800.00
Cement	Cwt	178	5.00	890.00
Topsoil	CY	20	6.00	120.00
Sod	SY	370	1.30	481.00
Handrail, Type E	LF	125	30.00	3,750.00
Sheet Pile Flood Wall, Sta. 172+40 to Sta. 186+20 Lt. Bank				
Site Work				
Excavation, Common	CY	39	3.00	117.00
Excavation, Stripping	CY	269	2.00	538.00
Fill	CY	2,650	2.50	6,625.00
Topsoil	CY	108	6.00	648.00
Seeding, Fertilizing & Mulching	Acre	0.2	700.00	140.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Sheet Pile Flood Wall, Sta. 172+40 to Sta. 186+20 Lt. Bank (Cont'd)				
Wall Construction				
PZ-27 Sheet Pile	SF	33,840	16.00	541,440.00
Concrete Cap, Anchor, and Deadman				
Excavation, Structure	CY	1,759	6.00	10,554.00
Backfill	CY	1,827	3.00	5,481.00
Backfill Granular	CY	13	9.00	117.00
Concrete	CY	505	215.00	108,575.00
Reinforcing Steel	Lbs	56,400	0.40	22,560.00
Cement	Cwt	3,583	5.00	17,915.00
Anchors & Wales	Lbs	125,299	2.00	250,598.00
Drilling for Anchors	LF	15	3.00	45.00
Handrail, Type B	LF	963	70.00	67,410.00
Handrail, Type E	LF	308	30.00	9,240.00
Contingencies	~15 percent			323,603.10
Subtotal Flood and Wing Walls				$2,480,000.00
Aesthetic Improvements *				
Flood and Wing Walls				720,000.00
Total Flood and Wing Walls				$3,200,000.00
Concrete Platform and Boat Ramp at Sta. 156+00 Lt. Bank				
Concrete Platform				
Subgrade, Fine Grading	SY	280	0.50	140.00
Concrete	CY	69	115.00	7,935.00
Reinforcing Steel	Lbs	7,590	0.40	3,036.00
Cement	Cwt	490	5.00	2,450.00
Granular Base	Ton	56	6.00	336.00
Boat Ramp				
Ramp	Job	Sum	***	19,200.00
Bedding	CY	88	12.50	1,100.00
Riprap, Type A	CY	37	21.00	777.00
Contingencies	15 Percent			5,226.00
Total Concrete Platform and Boat Ramp				$40,200.00

* See Non-Federal First Costs, Betterments: Cost-shared Aesthetic Improvements Credit per 1988 Agreement Between CENCS & Local Sponsor.

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Removals				
Stone Walls				
Sta. 125+70 to Sta. 126+60 on Rt. Bank	Job	Sum	***	700.00
Sta. 126+30 to Sta. 126+80 on Lt. Bank	Job	Sum	***	200.00
Sta. 180+75 to Sta. 182+60 on Lt. Bank	Job	Sum	***	400.00
Sta. 183+10 to Sta. 184+75 on Rt. Bank	Job	Sum	***	500.00
Sta. 185+90 to Sta. 186+75 on Rt. Bank	Job	Sum	***	200.00
Sta. 188+05 to Sta. 188+65 on Rt. Bank	Job	Sum	***	200.00
Sta. 190+00 to Sta. 191+45 on Rt. Bank	Job	Sum	***	250.00
Sta. 193+10 to Sta. 193+45 on Rt. Bank	Job	Sum	***	100.00
Wood Walls				
Sta. 174+05 to Sta. 174+35 on Lt. Bank	Job	Sum	***	300.00
Sta. 174+55 to Sta. 176+30 on Lt. Bank	Job	Sum	***	1,300.00
Concrete Walls				
Sta. 126+30 to Sta. 126+80 on Lt. Bank	Job	Sum	***	1,000.00
Sta. 203+50 to Sta. 204+97 on Lt. Bank, including Foundation Piles	Job	Sum	***	8,000.00
Concrete Shoreline Protection Matting				
Sta. 152+50 to Sta. 156+30 on Lt. Bank	Job	Sum	***	3,200.00
Footbridge Abutment at Sta. 193+00 on Rt. Bank	Job	Sum	***	500.00
12" C.S.P Inverted Siphon at Sta. 170+80	Job	Sum	***	1,500.00
Sheet Piling & Flap Gate at Sta. 159+00 on Lt. Bank	Job	Sum	***	2,000.00
48" R.C.P. and Bulkhead at Sta. 159+90 on Lt. Bank	Job	Sum	***	1,000.00
Power Dam, No. Z-2 at Sta. 169+60	Job	Sum	***	11,000.00
24" x 28" CMP at Sta. 174+00 on Lt. Bank	Job	Sum	***	140.00
Inlet Structure at Sta. 174+15 on Lt. Bank	Job	Sum	***	500.00
Contingencies	~15 Percent			4,910.00
Total Removals				$37,900.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Channel Work				
Clearing and Grubbing	Acre	9.3	2,000.00	18,600.00
Excavation				
Stripping	CY	5,253	2.00	10,506.00
Dredging	CY	50,465	4.00	201,860.00
Common	CY	218,512	3.00	655,536.00
Rock	CY	14,922	10.00	149,220.00
Fill	CY	32,332	2.50	80,830.00
Rock Fill				
Type C	CY	2,847	17.00	48,399.00
Type E	CY	5,581	17.00	94,877.00
Bedding for Riprap	CY	14,540	12.50	181,750.00
Riprap				
Type A	CY	11,049	21.00	232,029.00
Type B	CY	8,931	21.00	187,551.00
Type D	CY	5,117	21.00	107,457.00
Concrete Toe Protection				
Concrete	CY	67	115.00	7,705.00
Reinforcing Steel (Temperature Steel)	Lbs	9,400	0.40	3,760.00
Cement	Cwt	476	5.00	2,380.00
Topsoil	CY	2,770	6.00	16,620.00
Seeding, Fertilizing and Mulching	Acre	5	700.00	3,500.00
Sodding	SY	170	1.30	221.00
Concrete Beam Guardrail	LF	180	25.00	4,500.00
Landscaping	Job	Sum	***	19,604.00
Contingencies ~15 Percent				304,095.00
Total Channel Work				$2,331,000.00
Outlet Modifications				
Sta. 125+79 Rt.				
48" Pipe thru Flood Wall	Job	Sum	***	100.00
Sta. 157+17 Rt.				
12" Pipe thru Underpass Wall	Job	Sum	***	120.00
Sta. 158+26 Lt., 18" RCP Outlet				
Remove 18" RCP	LF	6	5.00	30.00
Sta. 162+77 Lt., 60" RCP Outlet				
Remove 60" RCP	LF	22	10.00	220.00
60" RCP, C1-2	LF	20	150.00	3,000.00
Sta. 165+82 Lt., 12" RCP Outlet				
12" RCP C1-2	LF	6	21.00	126.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Outlet Modifications (Cont'd)				
Sta. 173+54 Lt., 48" CMP thru Sheet Pile Wall				
Remove 36" RCP	LF	60	6.00	360.00
48" RCP, C1-2	LF	64	75.00	4,800.00
48" CMP	LF	16	35.00	560.00
60" Dia. Manhole	Each	1	1,500.00	1,500.00
Special Manhole	Each	1	3,000.00	3,000.00
Sta. 174+24 Lt., 2 Each 32" CMP				
Plug	Job	Sum	***	100.00
Sta. 176+58 Lt., 24" CMP thru Sheet Pile Wall				
Remove 20" DIP	LF	20	5.00	100.00
24" CMP	LF	14	20.00	280.00
Catch Basin	Each	1	800.00	800.00
Sta. 176+90 Lt., 72" CMP thru Sheet Pile Wall				
72" CMP	LF	34	75.00	2,550.00
96" Dia. Manhole	Each	1	3,000.00	3,000.00
Sta. 180+10 Lt., 30" CMP thru Sheet Pile Wall				
Remove 36" x 24" Arch RCP	LF	26	6.00	156.00
30" CMP	LF	14	22.00	308.00
Manhole	Each	1	900.00	900.00
Sta. 180+47 Lt., 18" CMP thru Sheet Pile Wall				
Remove 18" RCP	LF	30	5.00	150.00
18" CMP	LF	15	18.00	270.00
Catch Basin	Each	1	800.00	800.00
Sta. 186+08 Rt., 21" R.C.P. thru Underpass Ret. Wall				
21" RCP, C1-3	LF	62	26.00	1,612.00
Manhole	Each	1	900.00	900.00
Plug Exist. 21" RCP	Each	2	50.00	100.00
Sta. 186+40 Lt., 24" RCP Outlet				
Remove 24" RCP	LF	74	5.00	370.00
24" RCP, C1-2	LF	32	30.00	960.00
Manhole	Each	1	900.00	900.00
Sta. 190+20 Rt., 12" RCP Outlet				
Remove 12" RCP	LF	10	5.00	50.00
12" RCP, C1-3	LF	30	21.00	630.00
Manhole	Each	1	900.00	900.00
Sta. 191+70 Rt., 12" PVC Outlet				
Remove 12" PVC Pipe	LF	15	5.00	75.00
12" RCP, C1-2	LF	26	21.00	546.00
Manhole	Each	1	900.00	900.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Outlet Modifications (Cont'd)				
Sta. 202+49 Rt., 42" RCP Outlet				
Remove 42" RCP	LF	24	6.00	144.00
42" RCP, C1-2	LF	38	65.00	2,470.00
60" Dia. Manhole	Each	1	1,500.00	1,500.00
Sta. 202+88 Lt.				
Remove 24" RCP	LF	21	5.00	105.00
24" RCP thru Flood Wall	Job	Sum	***	100.00
Sta. 1+40 Rt., 24" RCP Outlet				
Remove 24" RCP	LF	37	5.00	185.00
24" RCP, C1-2	LF	34	30.00	1,020.00
Sta. 4+05 Lt., 36" RCP Outlet				
Remove 36" RCP	LF	20	6.00	120.00
36" RCP, C1-2	LF	20	50.00	1,000.00
Sta. 6+00 Rt., 15" RCP Outlet				
Remove 15" CMP	LF	40	5.00	200.00
15" RCP, C1-2	LF	60	25.00	1,500.00
Manholes	Each	2	900.00	1,800.00
Plug Pipes	Each	2	50.00	100.00
Contingencies ~15 Percent				6,083.00
Total Outlet Modifications				$47,500.00
Miscellaneous Structures				
Gate Well A at Sta. 160+00 Lt.	Job	Sum	***	27,500.00
Log Skimmer at Sta. 168+90 Lt.	Job	Sum	***	500.00
Contingencies 15 Percent				4,200.00
Total Miscellaneous Structures				$32,200.00
Drainage Facility				
Culvert at Sta. 168+50 Rt.				
Trench Excavation	CY	235	2.00	470.00
Backfill	CY	250	1.00	250.00
36" RCP, 1500D	LF	62	50.00	3,100.00
36" RCP, Apron	Each	1	500.00	500.00
Contingencies ~15 Percent				650.00
Total Drainage Facility				$4,970.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Silver Lake Dam Modifications				
Concrete Removal				
Apron	CY	34	155.00	5,270.00
Ogee	CY	261	155.00	40,455.00
Right Abutment	CY	24	155.00	3,720.00
Pier No. 3	CY	33	155.00	5,115.00
Access Bridge	CY	19	155.00	2,945.00
Concrete				
Ogee	CY	337	115.00	38,755.00
Right Abutment	CY	133	170.00	22,610.00
Pier No. 3	CY	107	170.00	18,190.00
Access Bridge & Pier Repair	CY	13	170.00	2,210.00
Apron	CY	520	170.00	88,400.00
Reinforcing Steel				
Ogee	Lbs	28,630	0.50	14,315.00
Right Abutment	Lbs	11,300	0.50	5,650.00
Pier No. 3	Lbs	9,030	0.50	4,515.00
Access Bridge	Lbs	990	0.50	495.00
Tremic Concrete	CY	62	80.00	4,960.00
Apron	Lbs	44,200	0.50	22,100.00
Cement				
Ogee	Cwt	2,393	5.00	11,965.00
Right Abutment	Cwt	944	5.00	4,720.00
Pier No. 3	Cwt	760	5.00	3,800.00
Access Bridge & Pier Repair	Cwt	92	5.00	460.00
Tremic Concrete	Cwt	440	5.00	2,200.00
Apron	Cwt	3,692	5.00	18,460.00
PZ22 Sheet Piling				
Downstream	SF	7,070	13.50	95,445.00
Upstream	SF	6,690	13.50	90,315.00
25 Ton Soil Anchors	Each	6	1,860.00	11,160.00
30 Ton Soil Anchors	Each	20	2,170.00	43,400.00
12" Treated Timber Piling Delivered & Drivened	LF	500	36.00	18,000.00
Handrailing				
Right Abutment	LF	41	21.00	861.00
Access Bridge	LF	140	29.00	4,060.00
Miscellaneous				
Doors, Windows, & Skylights	Job	Sum	***	6,510.00
Metal Roofing	SF	370	5.20	1,924.00
Framing Lumber	FBM	775	3.20	2,480.00
Miscellaneous Metals				
Stainless Plates, Etc.	Job	Sum	***	31,000.00
Ladder	Job	Sum	***	1,040.00
Access Bridge	Job	Sum	***	17,920.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Silver Lake Dam Modifications (Cont'd)				
Mechanical Construction				
Hinged Leaf Gate	Job	Sum	***	738,600.00
Tainter Gate Modifications	Job	Sum	***	6,700.00
Cylinders	Job	Sum	***	51,650.00
Trunion Supports	Job	Sum	***	10,330.00
Hydraulic Power Unit w/Controls and Manifold	Job	Sum	***	20,660.00
Hydraulic Piping	Job	Sum	***	36,155.00
Tainter Gate Hoist Removal and New Mounting	Job	Sum	***	10,330.00
Electrical Construction				
Service Switch and Service Connections	Job	Sum	***	3,720.00
Distribution Panels	Job	Sum	***	3,720.00
Step-Down Transformer	Job	Sum	***	2,380.00
Lighting	Job	Sum	***	830.00
Conduit				
1"	Job	Sum	***	5,060.00
1-1/4"	Job	Sum	***	8,680.00
Trenching and Backfilling	Job	Sum	***	1,240.00
Conductors				
#12	Job	Sum	***	1,450.00
# 8	Job	Sum	***	1,860.00
# 6	Job	Sum	***	1,140.00
Leaf Gate Controls	Job	Sum	***	9,920.00
Leaf Gate Equipment Connections	Job	Sum	***	3,410.00
De-icing System	Job	Sum	***	23,760.00
Tainter Gate Hoist Connections	Job	Sum	***	7,440.00
Miscellaneous	Job	Sum	***	21,200.00
Dewatering	Job	Sum	***	161,630.00
Contingencies ~15 Percent				266,710.00
Total Silver Lake Modifications.....				$2,044,000.00
Restoration of Streets, Roads, Parking Lots, and Sidewalks				
Cemetery Roads				
Remove and Reinstall Chainlink Fence	LF	415	6.00	2,490.00
Remove Bituminous Pavement	SY	430	2.50	1,075.00
Excavation, Common	CY	72	3.00	216.00
Excavation, Stripping	CY	181	2.00	362.00
Subgrade, Fine Grading	SY	464	0.50	232.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Restoration of Streets, Roads, Parking Lots, and Sidewalks (Cont'd)				
Cemetery Roads (Cont'd)				
Bituminous Pavement				
Bituminous Mat'l for Mix	Ton	25	208.00	5,200.00
Bituminous Wearing Course	Ton	370	13.20	4,884.00
Bituminous Base Course	Ton	47	13.20	620.40
Bituminous Tack Coat	Gal	224	1.50	336.00
Crushed Stone Base	Ton	120	6.00	720.00
Topsoil	CY	68	6.00	408.00
Sod	SY	610	1.30	793.00
2nd Avenue NE				
Remove Bituminous Pavement	SY	119	2.50	297.50
Remove Concrete Curb and Gutter	LF	65	4.20	273.00
Remove Concrete Sidewalk	SY	36	4.00	144.00
Remove & Replace Barricade	LF	62	20.00	1,240.00
Subgrade, Fine Grading	SY	119	0.50	59.50
Bituminous Pavement				
Bituminous Mat'l for Mix	Ton	3	208.00	624.00
Bituminous Wearing Course	Ton	13	13.20	171.60
Bituminous Base Course	Ton	39	13.20	514.80
Bituminous Tack Coat	Gal	6	1.50	9.00
Crushed Stone Base	Ton	60	6.00	360.00
Concrete Sidewalk and Curb & Gutter				
Granular Base	Ton	6	6.00	36.00
Concrete	CY	8	115.00	920.00
Cement	Cwt	57	5.00	285.00
Sod	SY	42	1.30	54.60
2nd Street NE and Parking Lot				
Excavation, Common	CY	39	3.00	117.00
Aggregate Surfacing	Ton	66	8.50	561.00
Remove Barricade	LF	32	2.00	64.00
Remove & Replace Chainlink Fence	LF	210	10.00	2,100.00
Guard Post Barriers, Type C	Each	8	100.00	800.00
1st Street NE & Bituminous Parking Lot				
Remove Bituminous Pavement	SY	1,211	2.50	3,027.50
Excavation, Common	CY	170	3.00	510.00
Subgrade, Fine Grading	SY	361	0.50	180.50

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Restoration of Streets, Roads, Parking Lots, and Sidewalks (Cont'd)				
1st Street NE & Bit. Parking Lot (Cont'd)				
Bituminous Pavement				
Bituminous Mat'l for Mix	Ton	4	208.00	832.00
Bituminous Wearing Course	Ton	53	13.20	699.60
Bituminous Base Course	Ton	24	13.20	316.80
Bituminous Tack Coat	Gal	6	1.50	9.00
Crushed Stone Base	Ton	98	6.00	588.00
Aggregate Surfacing	Ton	68	8.50	578.00
Remove Barricade	LF	32	2.00	64.00
Remove & Replace Chainlink Fence	LF	310	10.00	3,100.00
Guard Post Barriers, Type C	Each	9	100.00	900.00
Parking Lot and Entrance at Park and Recreation Bldg.				
Remove Bituminous Pavement	SY	1,516	2.50	3,790.00
Excavation, Common	CY	253	3.00	759.00
Subgrade, Fine Grading	SY	1,061	0.50	530.50
Bituminous Pavement				
Bituminous Mat'l for Mix	Ton	18	208.00	3,744.00
Bituminous Wearing Course	Ton	117	13.20	1,544.40
Bituminous Base Course	Ton	233	13.20	3,075.60
Bituminous Tack Coat	Gal	53	1.50	79.50
Crushed Stone Base	Ton	322	6.00	1,932.00
Sod	SY	636	1.30	826.80
East Center Street				
Remove Concrete Pavement	SY	235	7.00	1,645.00
Remove Concrete Sidewalk	SY	13	4.00	52.00
Subgrade, Fine Grading	SY	235	0.50	117.50
Portland Cement Pavement and Curb				
Concrete	CY	60	115.00	6,900.00
Reinforcing Steel	Lbs	4,800	0.40	1,920.00
Cement	Cwt	426	5.00	2,130.00
Expansion Joint Material	LF	116	2.00	232.00
Concrete Sidewalk				
Concrete	CY	2	115.00	230.00
Cement	Cwt	14	5.00	70.00
Granular Base	Ton	2	6.00	12.00
Sod	SY	72	1.30	93.60

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
9 Channel				
Restoration of Streets, Roads, Parking Lots, and Sidewalks (Cont'd)				
Mayo Park Drive				
Remove Bituminous Surface	SY	1,175	2.50	2,937.50
Excavation, Common	CY	65	3.00	195.00
Subgrade, Fine Grading	SY	1,175	0.50	587.00
Bituminous Pavement				
Bituminous Mat'l for Mix	Ton	12	208.00	2,496.00
Bituminous Wearing Course	Ton	97	13.20	1,280.40
Bituminous Base Course	Ton	129	13.20	1,702.80
Crushed Stone Base	Ton	357	6.00	2,142.00
Topsoil	CY	81	6.00	486.00
Sod	SY	738	1.30	959.00
Parking Lot of County Health Center				
Remove Bituminous Surface	SY	422	2.50	1,055.00
Excavation, Common	CY	70	3.00	210.00
Subgrade, Fine Grading	SY	217	0.50	108.50
Bituminous Pavement				
Bituminous Mat'l for Mix	Ton	2	208.00	416.00
Bituminous Wearing Course	Ton	36	13.20	475.20
Crushed Stone Base	Ton	55	6.00	330.00
Mayo Civic Center				
Remove Bituminous Sidewalk	SY	49	2.50	122.50
Remove Concrete Sidewalk	SY	80	4.00	320.00
Bituminous Sidewalk				
Bituminous Mat'l for Mix	Ton	0.3	208.00	62.40
Bituminous Wearing Course	Ton	5	13.20	66.00
Crushed Stone Base	Ton	10	6.00	60.00
Concrete Sidewalk				
Concrete	CY	9	115.00	1,035.00
Cement	Cwt	64	5.00	320.00
Granular Base	Ton	8	6.00	48.00
Contingencies	~15 Percent			12,529.00
Total Restoration of Streets, Roads, Parking Lots, and Sidewalks				$96,400.00
Restoration of Railroad				
Track Work and Loss of Time	Job	Sum	***	18,610.00
Contingencies	~15 Percent			2,790.00
Total Restoration of Railroad				$21,400.00
Total 9 Channel				$9,151,920.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
14 Recreation Facilities				
Bike Paths (Bituminous)				
Excavation, Common	CY	549	2.00	1,098.00
Excavation, Stripping	CY	52	2.00	104.00
Embankment, Compacted Fill	CY	215	1.50	322.50
Subgrade, Fine Grading	SY	3,450	0.50	1,725.00
Bituminous Pavement				
Bituminous Material for Mix	Ton	20	208.00	4,160.00
Bituminous Wearing Course	Ton	340	13.20	4,488.00
Crushed Stone Base	Ton	698	6.00	4,188.00
Handrail, Type G	LF	240	40.00	9,600.00
Topsoil	CY	50	6.00	300.00
Seeding, Fertilizing & Mulching	Acre	0.5	700.00	350.00
Landscaping	Job	Sum	***	38,532.00
Signs	Each	15	50.00	750.00
Contingencies ~15	Percent			9,842.50
Total Bike Paths (Bit.)				$75,460.00
Bike Paths (Concrete)				
Sta. 165+15 Rt. to Sta. 169+05 Rt.				
Concrete Pavement				
Bedding	CY	121	12.50	1,512.50
Concrete	CY	94	115.00	10,810.00
Reinforcing Steel	Lbs	9,400	0.40	3,760.00
Cement	Cwt	667	5.00	3,335.00
Handrail, Type G	LF	447	40.00	17,880.00
Sta. 177+50 Rt. to Sta. 183+67 Rt.				
Subgrade, Fine Grading	SY	788	0.50	394.00
Concrete Pavement				
Crushed Stone Base	Ton	239	6.00	1,434.00
Concrete	CY	145	115.00	16,675.00
Reinforcing Steel	Lbs	14,510	0.40	5,804.00
Cement	Cwt	1,030	5.00	5,150.00
Handrail, Type G	LF	677	40.00	27,080.00
Sta. 189+00 Rt. to Sta. 193+45 Rt.				
Concrete Pavement				
Concrete	CY	110	115.00	12,650.00
Reinforcing Steel	Lbs	11,000	0.40	4,400.00
Cement	Cwt	781	5.00	3,905.00
Handrail, Type G	LF	550	40.00	22,000.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
14 Recreation Facilities				
Bike Paths (Concrete) (Cont'd)				
Sta. 176+26 Lt. to Sta. 183+95 Lt.				
Remove Bituminous Pavement	SY	407	2.50	1,017.50
Excavation, Common	CY	149	3.00	447.00
Subgrade, Fine Grading	SY	957	0.50	478.50
Concrete Pavement				
Granular Base	Ton	106	6.00	636.00
Concrete	CY	100	115.00	11,500.00
Cement	Cwt	710	5.00	3,550.00
Topsoil	CY	119	6.00	714.00
Sod	SY	1,083	1.30	1,407.90
Drainage				
12" RCP, Cl-3	LF	54	21.00	1,134.00
Flap Gate for 12" RCP	Ea	2	200.00	400.00
Catch Basin	Ea	3	800.00	2,400.00
Landscaping	Job	Sum	***	10,410.00
Sta. 184+50 Lt. to Sta. 194+00 Lt.				
Excavation, Common	CY	378	3.00	1,134.00
Subgrade, Fine Grading	SY	1,387	0.50	693.50
Concrete Pavement				
Granular Base	Ton	117	6.00	702.00
Concrete	CY	122	115.00	14,030.00
Cement	Cwt	866	5.00	4,330.00
Bituminous Pavement				
Bituminous Mat'l for Mix	Ton	2	208.00	416.00
Bituminous Wearing Course	Ton	23	13.20	303.60
Crushed Stone Base	Ton	47	6.00	282.00
Topsoil	CY	287	6.00	1,722.00
Sod	SY	2,611	1.30	3,394.30
Drainage				
12" RCP, Cl-3	LF	95	21.00	1,995.00
Flap Gate for 12" RCP	Ea	2	200.00	400.00
Catch Basin	Ea	2	800.00	1,600.00
Landscaping	Job	Sum	***	12,709.00
Sta. 198+65 Lt. to Sta. 203+20 Lt.				
Excavation, Common	CY	141	3.00	423.00
Subgrade, Fine Grading	SY	586	0.50	293.00
Concrete Pavement				
Granular Base	Ton	45	6.00	270.00
Concrete	CY	46	115.00	5,290.00
Cement	Cwt	327	5.00	1,635.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
14 Recreation Facilities				
Bike Paths (Concrete) (Cont'd)				
Sta. 198+65 Lt. to Sta. 203+20 Lt.(Cont'd)				
Bituminous Pavement				
Bituminous Mat'l for Mix	Ton	1	208.00	208.00
Bituminous Wearing Course	Ton	16	13.20	211.20
Crushed Stone Base	Ton	29	6.00	174.00
Topsoil	CY	139	6.00	834.00
Sod	SY	1,268	1.30	1,648.40
Drainage				
12" RCP, C1-3	LF	50	21.00	1,050.00
Flap Gate for 12" RCP	Ea	2	200.00	400.00
Catch Basin	Ea	2	800.00	1,600.00
Landscaping	Job	Sum	***	15,778.00
Contingencies ~15 Percent				36,689.60
Total Bike Path (Concrete).....				$281,100.00
Bike Path Underpasses and Bike Path Approaches on Slopes				
7th Street NE Bridge				
Excavation, Structure	CY	630	6.00	3,780.00
Backfill, Granular	CY	226	9.00	2,034.00
Retaining Wall				
Concrete	CY	213	170.00	36,210.00
Reinforcing Steel	Lbs	31,950	0.40	12,780.00
Cement	Cwt	1,512	5.00	7,560.00
Concrete Pavement				
Concrete	CY	43	115.00	4,945.00
Reinforcing Steel	Lbs	2,800	0.40	1,120.00
Cement	Cwt	277	5.00	1,385.00
Expansion Joint Material	LF	212	2.00	424.00
Wall Toe Drain				
8" Perforated CMP	LF	150	9.00	1,350.00
Flap Gates for 8" CMP	Each	2	160.00	320.00
Handrail, Type A	LF	390	70.00	27,300.00
Electrical Lighting and Power	Job	Sum	***	2,000.00
Signs	Each	6	50.00	300.00
Contingencies ~15 Percent				15,226.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
14 Recreation Facilities				
Bike Path Underpasses and Bike Path Approaches on Slopes				
East Center Street Bridge, Sta. 183+67 to Sta. 189+00				
Excavation, Structure	CY	36	6.00	216.00
Excavation, Rock	CY	139	25.00	3,475.00
Underpinning				
Concrete	CY	184	170.00	31,280.00
Reinforcing Steel	Lbs	27,620	0.40	11,048.00
Cement	Cwt	1,306	5.00	6,530.00
Drilling for Rock Anchors	LF	230	5.00	1,150.00
Anchor Assemblies	Lbs	2,990	3.00	8,970.00
Concrete Pavement & Retaining Wall				
Concrete	CY	20	115.00	2,300.00
Reinforcing Steel	Lbs	2,241	0.40	896.40
Cement	Cwt	142	5.00	710.00
Expansion Joint Material	LF	85	2.00	170.00
Bikeway Bridges				
Concrete	CY	189	170.00	32,130.00
Reinforcing Steel	Lbs	36,918	0.40	14,767.20
Cement	Cwt	1,342	5.00	6,710.00
Handrail, Type A	LF	640	70.00	44,800.00
Electrical Lighting and Power	Job	Sum	***	2,000.00
Signs	Each	6	50.00	300.00
Contingencies	~15 Percent			25,117.40
3rd Avenue SE Bridge				
Excavation, Structure	CY	315	6.00	1,890.00
Backfill, Granular	CY	113	9.00	1,017.00
Retaining Wall				
Concrete	CY	107	170.00	18,190.00
Reinforcing Steel	Lbs	16,000	0.40	6,400.00
Cement	Cwt	756	5.00	3,780.00
Concrete Pavement				
Concrete	CY	22	115.00	2,530.00
Reinforcing Steel	Lbs	1,400	0.40	560.00
Cement	Cwt	156	5.00	780.00
Expansion Joint Material	LF	140	2.00	280.00
Wall Toe Drain				
8" Perforated CMP	LF	75	9.00	675.00
Flap Gate for 8" CMP	Each	1	160.00	160.00
Handrail, Type A	LF	260	70.00	18,200.00
Electrical Lighting and Power	Job	Sum	***	1,000.00
Signs	Each	3	50.00	150.00
Contingencies	~15 Percent			8,344.00
Total Bike Path Underpasses and Bike Path Approaches on Slopes				$373,260.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
14 Recreation Facilities				
Parking Area at Sta. 159+50 Lt. Bank				
Subgrade, Fine Grading	SY	747	0.50	373.50
Bituminous Pavement				
Bituminous Mat'l for Mix	Ton	11	208.00	2,288.00
Bituminous Wearing Course	Ton	72	13.20	950.40
Bituminous Base Course	Ton	144	13.20	1,900.80
Bituminous Tack Coat	Gal	33	1.50	49.50
Crushed Stone Base	Ton	199	6.00	1,194.00
Concrete Curb and Gutter				
Concrete	CY	22	115.00	2,530.00
Cement	Cwt	156	5.00	780.00
Contingencies	~15 Percent			1,513.80
Total Parking Area at Sta. 159+50 Lt. Bank				$11,580.00
River Accesses and Overlook Areas				
Sta. 160+30 Lt. Bank				
River Access				
Excavation, Structure	CY	74	9.50	703.00
Concrete	CY	27	275.00	7,425.00
Reinforcing Steel	Lbs	3,243	0.40	1,297.20
Cement	Cwt	192	5.00	960.00
Handrail, Type D	LF	30	25.00	750.00
Handrail, Type E	LF	11	30.00	330.00
Overlook				
Subgrade, Fine Grading	SY	198	0.50	99.00
Concrete Walk				
Granular Base	Ton	20	6.00	120.00
Concrete	CY	22	115.00	2,530.00
Cement	Cwt	156	5.00	780.00
Landscaping	Job	Sum	***	3,456.00
Sta. 176+00 Lt. Bank				
River Access				
Excavation, Structure	CY	250	9.50	2,375.00
Concrete	CY	54	275.00	14,850.00
Reinforcing Steel	Lbs	6,480	0.40	2,592.00
Cement	Cwt	383	5.00	1,915.00
Riprap, Type A	CY	31	21.00	651.00
Handrail, Type E	LF	73	30.00	2,190.00
Handrail, Type F	LF	95	15.00	1,425.00
PZ-27 Sheet Pile Wall	SF	2,655	16.00	42,480.00
Concrete Cap				
Concrete	CY	17	215.00	3,655.00
Reinforcing Steel	Lbs	1,360	0.40	544.00
Cement	Cwt	121	5.00	605.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
14 Recreation Facilities				
River Accesses and Overlook Areas (Cont'd)				
Sta. 176+00 Lt. Bank (Cont'd)				
Overlook				
Subgrade, Fine Grading	SY	147	0.50	73.50
Concrete Walk				
Concrete	CY	15	115.00	1,725.00
Cement	Cwt	106	5.00	530.00
Granular Base	Ton	15	6.00	90.00
Landscaping	Job	Sum	***	3,836.00
Sta. 195+20 Rt. Bank				
River Access				
Excavation, Structure	CY	83	9.50	788.50
Concrete	CY	31	275.00	8,525.00
Reinforcing Steel	Lbs	3,720	0.40	1,488.00
Cement	Cwt	220	5.00	1,100.00
Handrail, Type D	LF	42	25.00	1,050.00
Handrail, Type E	LF	11	30.00	330.00
Overlook				
Subgrade, Fine Grading	SY	210	0.50	105.00
Concrete Walk				
Granular Base	Ton	21	6.00	126.00
Concrete	CY	23	115.00	2,645.00
Cement	Cwt	163	5.00	815.00
Shelter	Job	Sum	***	8,000.00
Landscaping	Job	Sum	***	3,283.00
Sta. 196+00 Lt. Bank				
River Access				
Excavation, Structure	CY	1,250	9.50	11,875.00
Concrete	CY	200	170.00	34,000.00
Reinforcing Steel	Lbs	30,000	0.40	12,000.00
Cement	Cwt	1,420	5.00	7,100.00
Handrail, Type E	LF	75	30.00	2,250.00
Handrail, Type F	LF	70	15.00	1,050.00
Overlook				
Subgrade, Fine Grading	SY	934	0.50	467.00
Concrete Walk				
Granular Base	Ton	75	6.00	450.00
Concrete	CY	81	115.00	9,315.00
Cement	Cwt	575	5.00	2,875.00
Bituminous Walk				
Bituminous Mat'l for Mix	Ton	1	208.00	208.00
Bituminous Wearing Course	Ton	21	13.20	277.20
Crushed Stone Base	Ton	39	6.00	234.00
Topsoil	CY	153	6.00	918.00
Sod	SY	1,196	1.30	1,544.80

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DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
14 Recreation Facilities				
River Accesses and Overlook Areas (Cont'd)				
Sta. 196+00 Lt. Bank (Cont'd)				
Landscaping	Job	Sum	***	11,404.00
Contingencies	~15 Percent			33,289.80
Total River Accesses and Overlook Areas				$255,500.00
Bicycle and Pedestrian Bridge at Sta. 194+00				
Excavation, Structure	CY	310	9.50	2,945.00
Steel H Pile	LF	950	25.00	23,750.00
Reinforcing Steel	Lbs	22,500	0.40	9,000.00
Concrete	CY	172	250.00	43,000.00
Bridge Superstructure	Job	Sum	***	70,000.00
Bedding	CY	120	12.50	1,500.00
Riprap, Type B	CY	240	21.00	5,040.00
Contingencies	~15 Percent			23,285.00
Total Bicycle and Pedestrian Bridge at Sta. 194+00				$178,520.00
Electrical				
Distribution	LF	4,120	4.15	17,098.00
Area Lighting	Ea	48	565.00	27,120.00
Contingencies	~15 Percent			6,632.00
Total Electrical				$50,850.00
Sub-Total 14 Recreation Facilities				$1,226,270.00
30 Engineering & Design - 14 Recreation Facilities				147,152.00
31 Supervision & Administration - 14 Recreation Facilities				83,693.00
Supervision & Inspection			55,182.00	
Overhead			28,511.00	
Total 14 Recreation Facilities				$1,457,115.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
LERRDS *				
Lands				
Private Lands				
Cemetery				
Temporary ROW, 1.3 Acre	Job	Sum	***	5,300.00
Commercial				
Permanent ROW, 0.7 Acre	Job	Sum	***	5,900.00
Temporary ROW, 0.1 Acre	Job	Sum	***	450.00
Railroad				
Bike Path Easement	Job	Sum	***	500.00
Deadman Anchor Easement	Job	Sum	***	1,500.00
Sanitary Sewer Easement	Job	Sum	***	5,750.00
Agreement for Easement	Each	3	150.00	450.00
City Owned Lands				
Channel Improvement Easement, 26.0 Acre	Job	Sum	***	412,400.00
Recreation Permanent ROW, 2.0 Acre	Job	Sum	***	49,000.00
Construction Temporary Easement, 3.0 Acre	Job	Sum	***	13,500.00
Administration/Acquisition Costs	Job	Sum	***	70,000.00
Contingencies	~1 Percent			5,250.00
Total Lands				$570,000.00
Relocations				
15" Sanitary Sewer, Sta. 157+12 to Sta. 185+40 Rt. Bank				
Abandon Manholes				
Sta. 172+10 Rt., 8.6' Deep	Each	1	150.00	150.00
Sta. 174+60 Rt., 8.2' Deep	Each	1	150.00	150.00
Remove Manholes				
Sta. 171+40 Rt., 6.6' Deep	Each	1	250.00	250.00
Sta. 177+65 Rt., 16.1' Deep	Each	1	500.00	500.00
Sta. 181+00 Rt., 17.1' Deep	Each	1	500.00	500.00
Sta. 183+75 Rt., 16.1' Deep	Each	1	500.00	500.00
Remove 12" VCP				
Sta. 176+00 Rt. to Sta. 179+70 Rt.	LF	370	10.00	3,700.00
Sta. 180+40 Rt. to Sta. 184+80 Rt.	LF	440	10.00	4,400.00
Plug Pipes	Each	12	50.00	600.00

* LERRDS: Lands, Easements, Rights-of-Way, Relocations, and Damages

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
LERRDS				
Relocations (Cont'd)				
15" Sanitary Sewer, Sta. 157+12 to Sta. 185+40 Rt. Bank (Cont'd)				
Trench Excavation and Backfill				
Depth: 0' to 6'	LF	692	7.50	5,190.00
Depth: 6' to 10'	LF	1,339	11.00	14,729.00
Depth: 10' to 13'	LF	99	16.00	1,584.00
Depth: 13' to 15'	LF	21	22.00	462.00
Depth: 15' to 17'	LF	167	32.00	5,344.00
Depth: 17' to 19'	LF	94	38.00	3,572.00
Depth: 19' to 21'	LF	230	73.00	16,790.00
Trench Excavation, Rock	CY	425	21.00	8,925.00
Backfill, Granular	CY	238	6.50	1,547.00
15" Sanitary Sewer Pipe	LF	2,614	20.00	52,280.00
16" DIP w/Mechanical Joints	LF	112	28.00	3,136.00
30" Steel Casing by Bore & Jack	LF	62	120.00	7,440.00
Twin Siphons				
Trench Excavation	CY	640	5.00	3,200.00
Backfill	CY	462	3.00	1,386.00
Backfill, Granular	CY	370	6.50	2,405.00
10" DIP w/Mechanical Joints	LF	76	20.00	1,520.00
10" DIP w/Ball Joints, River Crossing	LF	224	120.00	26,880.00
Standard Sanitary Sewer Manholes				
Sta. 164+05 Rt., 8.7' Deep	Each	1	900.00	900.00
Sta. 166+03 Rt., 7.5' Deep	Each	1	900.00	900.00
Sta. 170+30 Rt., 5.0' Deep	Each	1	850.00	850.00
Sta. 171+58 Rt., 4.9' Deep	Each	1	850.00	850.00
Sta. 172+70 Rt., 6.7' Deep	Each	1	900.00	900.00
Sta. 174+58 Rt., 7.3' Deep	Each	1	900.00	900.00
Sta. 174+95 Rt., 10.5' Deep	Each	1	1,000.00	1,000.00
Sta. 176+00 Rt., 14.3' Deep	Each	1	1,500.00	1,500.00
Sta. 178+30 Rt., 6.5' Deep	Each	1	900.00	900.00
Sta. 179+75 Rt., 6.2' Deep	Each	1	900.00	900.00
Sta. 182+00 Rt., 6.3' Deep	Each	1	900.00	900.00
Sta. 182+00 Rt., 20.3' Deep	Each	1	5,000.00	5,000.00
60" Dia. Sanitary Sewer Manhole, Sta. 157+12 Rt., 10.7' Deep	Each	1	1,500.00	1,500.00
Siphon Manholes				
Sta. 158+68 Rt., 6.0' Deep	Each	1	4,000.00	4,000.00
Sta. 160+48 Rt., 7.5' Deep	Each	1	4,000.00	4,000.00
2" Insulation	SF	1,920	1.50	2,880.00
Restore Sanitary Sewer Service	Each	2	300.00	600.00
Overhead Power at Sta. 170+20 & Sta. 161+00 to Sta. 169+70 Rt.	Job	Sum	***	18,000.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Project First Costs				
LERRDS				
Relocations (Cont'd)				
10" Gas Line at Sta. 170+70 & Sta. 171+35 to Sta. 172+00 Rt.	Job	Sum	***	60,000.00
Overhead Power Sta. 181+30 to Sta. 184+90 Rt.	Job	Sum	***	6,000.00
4" Water Service at Sta. 184+00 Rt.	Job	Sum	***	8,000.00
Hydrant Extension Sta. 158+45 to Sta. 195+00 Lt.	Job	Sum	***	300.00
Raise Manholes				
Sta. 158+75 to Sta. 270+00 Lt.	Job	Sum	***	200.00
Sta. 158+85 to Sta. 220+00 Lt.	Job	Sum	***	200.00
Removal Building at Sta. 177+50 Lt.	Job	Sum	***	2,000.00
Contingencies ~15 Percent				43,540.00
Total Relocations				$333,900.00
Total LERRDS				$903,900.00
Sub-Total Project First Costs				$11,687,385.00
30 Engineering and Design - Other				1,952,848.00
31 Supervision and Administration - Other				781,807.00
Supervision & Inspection		469,018.00		
Overhead		312,789.00		
Total Project First Costs				$14,422,040.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Non-Federal First Costs				
14 Recreation Facilities				
Direct Costs (50% of Project First Costs, Sub-Total 14 Recreation Facilities)				613,135.00
Indirect Costs				
Engineering & Design (50% of Project First Costs, E & D for 14 Recreation Facilities)				73,576.00
Supervision & Administration (50% of Project First Costs, S & A for 14 Recreation Facilities)				41,846.50
Total 14 Recreation Facilities (Non-Federal)				$728,557.50
Flood Control Costs				
Total Project First Costs			14,422,040.00	
Less Total 14 Recreation Facilities (Project First Costs)			(1,457,115.00)	
Sub-Total Flood Control Costs			12,964,925.00	
Times Local Sponsor Cost Factor (per 1986 WRDA)			x 0.25	
Total Flood Control Costs				$3,241,231.25
Sub-Total Non-Federal Costs (Not Including Betterments)				$3,969,788.75
Cash Contribution				
Sub-Total Non-Federal Costs (Not Including Betterments)			3,969,788.75	
Less Total LERRDS Costs			(903,900.00)	
Total Cash Contribution				$3,065,888.75

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Non-Federal First Costs				
Betterments				
Aesthetic Improvements				
Flood and Wing Walls				
Concrete Flood Wall, Sta. 165+15 to Sta. 169+05 Rt. Bank				
Foundation Work				
Stripping	CY	120	2.00	240.00
Excavation, Structure	CY	1,598	6.00	9,588.00
Backfill	CY	2,323	3.00	6,969.00
Backfill, Granular	CY	202	9.00	1,818.00
Wall Construction				
Concrete	CY	366	170.00	62,220.00
Reinforcing Steel	Lbs	34,215	0.40	13,686.00
Cement	Cwt	2,386	5.00	11,930.00
Joint Filler	LF	66	2.00	132.00
Handrail, Type E	LF	406	30.00	12,180.00
Wall Toe Drain				
8" Perforated CMP	LF	562	9.00	5,058.00
Flap Gates for 8" CMP	Each	5	160.00	800.00
Landscaping	Job	Sum	***	5,408.00
Concrete Flood Wall & Wing Wall, Sta. 177+50 to Sta. 184+76 Rt. Bank				
Foundation Work				
Stripping	CY	304	2.00	608.00
Excavation, Structure	CY	6,710	6.00	40,260.00
Excavation, Rock	CY	774	25.00	19,350.00
Backfill	CY	5,994	3.00	17,982.00
Backfill, Granular	CY	613	9.00	5,517.00
Wall Construction				
Concrete	CY	1,271	170.00	216,070.00
Reinforcing Steel	Lbs	172,800	0.40	69,120.00
Cement	Cwt	9,024	5.00	45,120.00
Joint Filler	LF	72	2.00	144.00
Handrail, Type E	LF	746	30.00	22,380.00
Wall Toe Drain				
8" Perforated CMP	LF	1,060	9.00	9,540.00
Flap Gate for 8" CMP	Each	9	160.00	1,440.00
Topsoil	CY	244	6.00	1,464.00
Sod	SY	2,220	1.30	2,886.00
Landscaping	Job	Sum	***	10,140.00
Concrete Flood Wall, Sta. 187+45 to Sta. 193+45 Rt. Bank				
Foundation Work				
Stripping	CY	402	2.00	804.00
Excavation, Structure	CY	5,099	6.00	30,594.00
Excavation, Rock	CY	372	25.00	9,300.00
Backfill	CY	5,438	3.00	16,314.00
Backfill, Granular	CY	508	9.00	4,572.00

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
Non-Federal First Costs				
Betterments				
Aesthetic Improvements (Cont'd)				
Flood and Wing Walls (Cont'd)				
Concrete Flood Wall, Sta. 187+45 to Sta. 193+45 Rt. Bank (Cont'd)				
Wall Construction				
Concrete	CY	1,054	170.00	179,180.00
Reinforcing Steel	Lbs	137,460	0.40	54,984.00
Cement	Cwt	7,483	5.00	37,415.00
Joint Filler	LF	150	2.00	300.00
Handrail, Type E	LF	653	30.00	19,590.00
Wall Toe Drain				
8" Perforated CMP	LF	874	9.00	7,866.00
Flap Gates for 8" CMP	Each	7	160.00	1,120.00
Landscaping	Job	Sum	***	6,300.00
Concrete Flood Wall, Sta. 186+20 to Sta. 202+90 Lt. Bank				
Foundation Work				
Stripping	CY	809	2.00	1,618.00
Excavation, Structure	CY	17,207	6.00	103,242.00
Backfill	CY	23,935	3.00	71,805.00
Backfill, Granular	CY	1,651	9.00	14,859.00
Wall Construction				
Concrete	CY	3,162	170.00	537,540.00
Reinforcing Steel	Lbs	468,820	0.40	187,528.00
Cement	Cwt	22,450	5.00	112,250.00
Joint Filler	LF	303	2.00	606.00
Handrail, Type B	LF	1,464	70.00	102,480.00
Wall Toe Drain				
8" Perforated CMP	LF	1,867	9.00	16,803.00
Flap Gate for 8" CMP	Each	18	160.00	2,880.00
Contingencies	~15 Percent			316,065.00
Total Aesthetic Improvements - Flood and Wing Walls				$2,428,065.00
Reduction in Riprap from FDM design				(149,065.00)
Total Aesthetic Improvements				$2,279,000.00
Cost-shared Aesthetic Improvements Credit per 1988 Agreement Between CENCS & Local Sponsor				(720,000.00)
Total Betterments				$1,559,000.00
Total Non-Federal Costs (Including Betterments)				$4,845,125.00

DESIGN MEMORANDUM NO. 2 FEATURE
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B

APPENDIX E
CONSTRUCTIBILITY

APPENDIX E
CONSTRUCTIBILITY

TABLE OF CONTENTS

EXHIBITS

1. INTRODUCTION

Stage 1B channel modifications on the South Fork of the Zumbro River will extend from the North Broadway Street bridge 8,007 feet upstream o the 3rd Avenue SE bridge. This stage includes 500 feet of Bear Creek downstream of the 4th Street SE bridge. Work includes the following:

1) Modifications to the Silver Lake Dam

2) Scour Protection at the North Broadway Bridge

3) Scour Protection at the 7th Street NE Bridge

4) Scour Protection at the Dakota, Minnesota & Eastern Railroad Bridge (former Chicago & North Western Railroad)

5) Scour Protection at the Center Street Bridge

6) Channel Excavation from 1 foot to 5 feet in depth

7) Slope Protection with Riprap and Rockfill that varies from 1 Vertical on 3 Horizontal to 1 Vertical on 2 Horizontal

8) Approximately 400 feet of Wing Walls

9) 4,044 feet of Concrete Flood Walls

10) 1,195 feet of Sheet Pile Walls

11) One Shelter

12) One Boat Ramp

13) Four River Accesses

14) One Bicycle and Pedestrian Bridge

A bicycle path will be constructed on the right bank of the Zumbro River for the entire stage and on the left bank from 2nd Avenue NE to 3rd Avenue SE. The bicycle path right bank is approximately one mile long and includes bridge underpasses at 7th Street NE, Center Street, and 3rd Avenue SE. The bicycle path left bank is approximately five-eighths of a mile long.

Approximately 2,800 feet of 15-inch sanitary sewer along the right bank from 7th Street NE to East Center Street will be constructed, including 150 feet of twin 10-inch inverted siphons across Silver Creek.

This sewer will replace the existing 12-inch sanitary sewer siphon at Sta. 170+80 and 12-inch sanitary sewer on the right bank from Station 171+40 to Station 185+40.

2. CONSTRUCTION SEQUENCE

Stage 1B construction will be done in two phases. The first phase will be the modifications to Silver Lake dam and adjacent concrete floodwalls and wingwalls. This work will start in September and will use cofferdams to maintain the water level through the fall and winter months. The second phase will begin in April after the spring runoff has occurred. To eliminate as much water as possible in the river channel, the Silver Lake dam tainter gates must be raised. All work near or in the channel bottom shall be performed during the spring and summer and must be completed by mid-October. If work is not completed by mid-October work must stop and be continued in the spring so that Silver Lake can be refilled by 1 November. Careful consideration has been given to the following construction activities. Included with this list of activities is a construction schedule bar chart. See Exhibit D - Construction Schedule Bar Chart.

LIST OF ACTIVITIES FOR CONSTRUCTION SCHEDULE BAR CHART

1. Mobilization.

2. Construct cofferdam upstream and downstream of the Silver Lake Dam for tainter gate modification (left side of dam).

3. Modify tainter gate side of dam and construct new access bridge.

4. Construct concrete apron on left side of Silver Lake dam.

5. Remove existing concrete and stone wall and construct left bank floodwall and concrete side slope at Sta. 126+50.

6. Construct right bank flood wall and concrete slope, at Sta. 126+50.

7. Remove cofferdam upstream and downstream.

8. Raise tainter gates and lower water elevation to approximately 965.

9. Construct cofferdam upstream and downstream of the Silver Lake Dam for ogee modification (right side).

10. Modify ogee side of dam.

11. Construct concrete apron on right side of dam.

12. Remove cofferdam upstream and downstream.

13. Start Silver Lake channel dredging to 7th St. bridge (approximately Sta. 158+80).

14. Clearing and grubbing along banks to end of project.

15. Construct concrete scour protection and place gabions to left abutment and pier of Broadway Street bridge.

16. Excavate temporary channel along left edge of proposed channel from Sta. 155+00 to Sta. 205+00 and Sta. 6+50 of Bear Creek for dewatering purposes and remove a part (left side) of Dam No. Z-2.

17. Construct concrete scour protection to abutment and pier and place gabions on right side of North Broadway bridge.

18. Simultaneously construct scour protection to the left abutments on all bridges during the temporary channel excavation.

19. Remove and replace 48-inch C.I.P. storm sewer in right bank at Sta. 125+88 and remove rubble wall from Sta. 125+85 to Sta. 126+50.

20. Remove 8-inch and 10-inch siphons and install new twin 10-inch siphons at approximately Sta. 156+33.

21. Excavate channel from approximately Sta. 156+00 to South side of 7th Street bridge.

22. Shape banks to proper slopes (South side of 7th Street bridge) from Sta. 151+90 to Sta. 158+80 both right and left banks.

23. Begin outlet modification of storm sewers.

24. Construct wing wall extensions at 7th Street bridge.

25. Construct bicycle path underpass under the east end of 7th Street bridge.

26. Construct concrete scour protection and place 12-inch bedding and 21-inch riprap under 7th Street bridge.

27. Begin placement of bedding, riprap and rockfill.

28. Construct boat ramp and concrete platform at Sta. 156+00 left bank.

29. Construct bicycle path on slopes of both sides of 7th Street Bridge (north and south).

30. Construct river access at Sta. 160+30 left bank.

31. Remove 48-inch R.C.P. and bulkhead at diffuser box and construct Gate Well A (for power plant).

32. Construct concrete flood wall on right bank from Sta. 165+15 to Sta. 169+05 and Sta. 169+40 to Sta. 174+79.

33. Construct 15-inch sanitary sewer from 7th Street bridge o Center Street bridge and remove and/or abandon sanitary sewer and sanitary sewer manholes.

34. Excavate channel to Dakota, Minnesota and Eastern Railroad bridge and remove the rest of Dam No. Z-2.

35. Remove 12-inch C.S.P. sanitary sewer siphon at approximately Sta. 170+80.

36. Construct log skimmer in front of power plant intake structure (anytime).

37. Construct sheet pile wall on left bank from Sta. 172+37 to Sta. 174+40.

38. Shape left and right bank from Sta. 158+80 to Sta. 176+00.

39. Construct concrete scour protection and place bedding and gabions under Dakota, Minnesota & Eastern Railroad bridge.

40. Remove stone wall on left bank from Sta. 180+75 to Sta. 182+60.

41. Remove stone walls on right bank at north and south sides of Center Street and construct concrete wing wall extensions on right bank at north and south sides of Center Street bridge.

42. Excavate channel from Dakota, Minnesota and Eastern Railroad bridge to south side of Center Street bridge.

43. Construct flood wall on right bank from Sta. 177+50 to Sta. 184+76 and from Sta. 187+45 to Sta. 193+45.

44. Shape right bank slope from Sta. 176+00 to Sta. 186+50.

45. Construct sheet pile wall on left bank from Sta. 174+40 to Sta. 182+60.

46. Construct river access at Sta. 176+00.

47. Construct concrete flood wall on left bank from Sta. 186+20 to Sta. 202+90.

48. Construct bicycle path underpass under the east end of Center Street bridge, and construct bicycle path underpass approach bridges.

49. Construct concrete slope protection from Sta. 182+60 to Center Street bridge left abutment.

50. Construct concrete scour protection and place bedding and gabions under Center Street bridge.

51. Excavate channel from the south side of Center Street bridge to 4th Street SE bridge and 3rd Avenue SE bridge.

52. Remove stone walls at approximately -

Sta. 186+15 to 186+75 on right bank
Sta. 188+10 to 188+65 on right bank
Sta. 190+00 to 191+40 on right bank
Sta. 192+90 to 193+45 on right bank

53. Remove foot bridge abutment on right bank at approx. Sta. 193+05.

54. Remove existing concrete wall from Sta. 203+50 to 204+95.

55. Shape bank slopes from south side of Center Street bridge to 4th Street SE and 3rd Avenue SE bridge (right side).

56. Construct bicycle and pedestrian bridge at Sta. 194+00.

57. Construct bike underpass at 3rd Avenue SE bridge and construct underpass approach on left bank slope.

58. Construct river accesses at Sta. 195+20 right bank and 196+00 left bank.

59. Place bedding and riprap at 3rd Avenue SE bridge.

60. Construct shelter at Sta. 195+20.

61. Place bedding and gabions at 4th Street SE bridge.

62. Construct concrete wall from Sta. 202+90 to Sta. 204+95, left bank.

63. Construct bicycle path on the right bank.

64. Construct plate beam guardrail on right bank around Sta. 190+00.

65. Place topsoil, seed and mulch.

66. Reconstruct all disturbed portions of pavement on Center Street and entrance to Mayo Civic Center (possibly) with PC concrete.

67. Reconstruct parking lots disturbed by sanitary sewer location.

68. Redredge Silver Lake at conclusion of project if a siltation problem results from upstream channel excavation.

3. MAJOR CONSTRUCTION ACTIVITIES

Silver Lake Dam: The tainter gate side of the dam should be completed first, then the ogee portion. This allows opening the new tainter gates and lowering the upstream water to its lowest elevation for channel excavation and upstream construction in phase 2.

Clearing and Grubbing: The Contractor shall dispose of the cleared and grubbed trees and debris from along the construction limits by means acceptable to the City and the Corps of Engineers. Existing utilities within the construction limits will be located and marked.

After clearing and grubbing, all areas will be stripped to receive fill, riprap, and rockfill. Material suitable for topsoil should be temporarily stockpiled at predetermined locations.

Channel Excavation: The channel excavation through Silver Lake to the 7th Street bridge can be dredged prior to the opening of the new tainter gates. After the opening of the new tainter gates and lowering of the water elevation, a temporary low flow channel 20 feet wide can be constructed along the left portion of the channel from 7th Street bridge to 3rd Avenue SE bridge. This temporary channel is to contain the flow and dewater the right portion of the channel for excavation. Deepening of the channel bed varies from 1 foot to 5 feet below its present elevation. These operations shall take place during the spring and summer season and must be completed before mid-October.

During channel, slope, and flood wall excavations, bedrock will be encountered. (Bedrock locations are shown on the plans.) The estimated rippable depth is 0' -7'. Bedrock which cannot be ripped shall be removed by blasting, jackhammering, or other approved means. If blasting is required, the Contractor's blasting procedure shall conform to state laws and municipal ordinances.

Bank Improvement: During channel excavation, the Contractor shall shape banks to proper slope and elevation, then bank slopes can be protected with bedding, riprap, rockfill, and gabions. All materials used shall meet Corps of Engineers' specifications.

Riprap shall be placed on slopes ranging from 1 Vertical on 3 Horizontal to 1 Vertical on 2 1/2 Horizontal. Rockfill 6 feet deep shall be placed at 1 Vertical on 2 Horizontal slopes at specified locations.

Concurrently and/or prior to the bank improvements, removal of existing walls, and/or modifications, and construction of the new wing walls, river accesses, and flood walls should take place.

The flood walls are located as follows:

1) Left and right bank flood walls located directly downstream of the Silver Lake Dam from the dam abutments to the Broadway Street bridge abutments.

2) Concrete flood wall running on the right bank from Sta. 165+15 to Sta. 169+05, Sta. 169+40 to Sta. 174+79 (the north side of Dakota, Minnesota & Eastern Railroad bridge abutment), Sta. 177+50 to Sta. 184+76, and Sta. 187+45 to Sta. 193+45.

3) Sheet pile flood wall that runs along the left bank from Sta. 172+40 (the north side abutment of the Dakota, Minnesota & Eastern Railroad bridge) to Sta. 182+63. Due to limited space along the existing building at Sta. 181+00 and the Art Center building, a sheet pile wall deadman may be used rather than a

concrete deadman.

4) Sheet pile flood wall that runs on the left bank from the south abutment of Center Street bridge to Sta. 186+20.

5) Concrete flood wall running on the left bank from Sta. 186+20 to Sta. 202+90.

6) Remove portions of existing wall and construct new concrete flood wall that runs on the left bank from Sta. 202+90 to Sta. 205+00.

7) Existing sheet pile wall, Sta. 169+20 to Sta. 172+50, left bank. During construction, up to 11 feet of earth will be removed from in front of the wall prior o placement of rockfill. The sheet piling should be checked for bending and lateral resistance of toe with this earth removed, and the need for temporary bracing should be assessed.

8) Existing concrete wall, Sta. 182+50 to Center Street bridge, left bank. This wall should be considered for scour protection similar to the adjacent bridge abutment. The structural adequacy of the retaining wall should be checked for conformance to current loading specifications for flood walls.

Wing Wall extensions are required at the following locations:

1) 7th St. NE bridge has four existing concrete wing walls which require extensions with sheet pile walls approximately 130 feet in total length.

2) Center Street bridge has two concrete wing walls to be extended on the right bank for a total length of approximately 184 feet.

River access is required at the following locations:

1) Sta. 160+30 Lt. Bank
2) Sta. 176+00 Lt. Bank
3) Sta. 195+20 Rt. Bank
4) Sta. 196+00 Lt. Bank

Storm Sewer Outlets: The construction of storm sewer outlets will be completed simultaneously with bank improvements. The outlet pipe may have to be shortened or lengthened depending upon the cutting or filling required on the bank.

Scour Protection to Bridges: While the river is at its low water condition, the scour protection can be completed on four bridges:

1) North Broadway Bridge
2) 7th Street NE Bridge

3) Dakota, Minnesota & Eastern Railroad Bridge
4) Center Street Bridge

The scour protection to these bridges consists of concrete additions to the abutments and piers. Prior to diversion of the water through the temporary channel, the scour protection must be completed on the left abutments. The channel bottom will receive granular bedding and gabions, or riprap, as specified on the plans.

When constructing scour protection and sheetpile wall (at the west abutment) underneath the Dakota, Minnesota & Eastern Railroad bridge, it will be necessary to schedule construction closely with the Dakota, Minnesota & Eastern Railroad Company train schedules. As of December, 1986, there is no definite train schedule and daily train traffic is one or two trains each way per day.

Construction of 15-inch Sanitary Sewer on the Right Bank:

Construction of the 15-inch sanitary sewer must be coordinated with the construction of the floodwall, wingwall, and bank protection. Foreseeable problems with the construction of the sewer line are:

1) Boring under the railroad tracks. Proposed sewer flow line is within approximately one foot of the top of bedrock. A horizontal rock boring may be required to install a 30-inch steel casing if rock is encountered during the boring and jacking operations.

2) The floodwall from Sta. 169+40 to Sta. 174+79 must be constructed before the sewer line can be installed due to the depth of the floodwall.

3) Due to the depth (approximately 20 feet deep) of the 15-inch sanitary sewer, the construction of the wingwall from Sta. 182+70 to Sta. 184+75 must be completed first.

4) The Park and Recreation Department will have some temporary inconvenience during the construction of the sanitary sewer across Center Street and through Park and Recreation's parking lot. Center Street may be temporarily closed during the sanitary sewer construction.

In summary, the construction of the 15-inch sanitary sewer will have to be closely scheduled and coordinated with construction of floodwalls and wing walls.

Bicycle Path: The bicycle path will be constructed in the following three phases:

Phase One - Construction of three underpasses;

Phase Two - Construction of bank slope approaches to underpasses, bicycle and pedestrian bridge, and shelter.

Phase Three - Construction of bicycle path including excavation, embankment, subgrading, placing of aggregate base material, and concrete or asphalt surfacing material.

Phase Three must take place during the paving season which is approximately May 15 to November 1. Reconstruction of parking lots disturbed by sanitary sewer and bank slope construction must also be completed during the paving season.

Cleanup: Final stages of construction will include disposal of excess materials, placing top soil, sodding, seeding and mulching, and general cleanup of the project area.

Boat Ramp and Concrete Platform: Construction to be coordinated with placement of riprap and bedding on the channel slopes.

3rd Avenue SE Bridge: The City of Rochester is currently in the process of designing a new bridge to replace the existing 3rd Avenue SE bridge. The construction of a new bridge at this location will alter the final design of the channel and will change quantities.

4. POWER PLANT

In a typical year, the Silver Lake power plant uses river water for cooling purposes from September 1 to June 1 when river water temperature is below 70°F. Well water is used as a cooling source from June 1 to September 1 when water temperature is above 70°F. The construction schedule shall be coordinated with Rochester Public Utilities.

5. HAUL ROADS

Temporary access roads must be constructed for hauling purposes. The access roads to the channel bottom will be used for removing excavated material from the channel and slopes, and may be used to haul in bedding, riprap and rockfill material. There are several streets adjacent to the project site that may be used for hauling purposes, but the Contractor will need an agreement with the City to repair construction related street damage when the project is completed. A temporary access bridge and road could be constructed by the use of floating barges across Silver Creek.

Certain roads in the cemetery may be used as haul roads with the Owner's permission. It will be the Contractor's responsibility to restore the roads which may be damaged by construction operations.

The disposal sites for excess excavated materials are indicated on Exhibit E and possible haul routes are shown on Exhibit A.

6. DISPOSAL AREAS

Disposal of an estimate 400,000 cubic yards of excavated material is

required. The disposal sites for excess excavated materials are indicated on Exhibit E.

7. COFFERDAMS AND DEWATERING

The use of cofferdams will be necessary in several project construction phases; for example, the dam modification, bridge scour protection, bridge piers, and concrete flood walls. The cofferdams should be low enough to permit overtopping or breaching to minimize the effect of upstream flooding.

8. CONSTRUCTION MATERIAL AVAILABLE

Construction materials required for the project consist of 28,400 C.Y. of riprap, 18,700 C.Y. of granular bedding, 5,000 C.Y. of fill for gabion baskets, and 8,400 C.Y. of rockfill. All the materials mentioned above, including the coarse aggregate for concrete, can be obtained from the following two quarries in the Rochester area. These two quarries lie in the Shakopee and Oneota formations.

1) Goldberg Quarry located five miles north on Highway 63 from Broadway Street bridge and one mile west on C.S.A.H. 14.

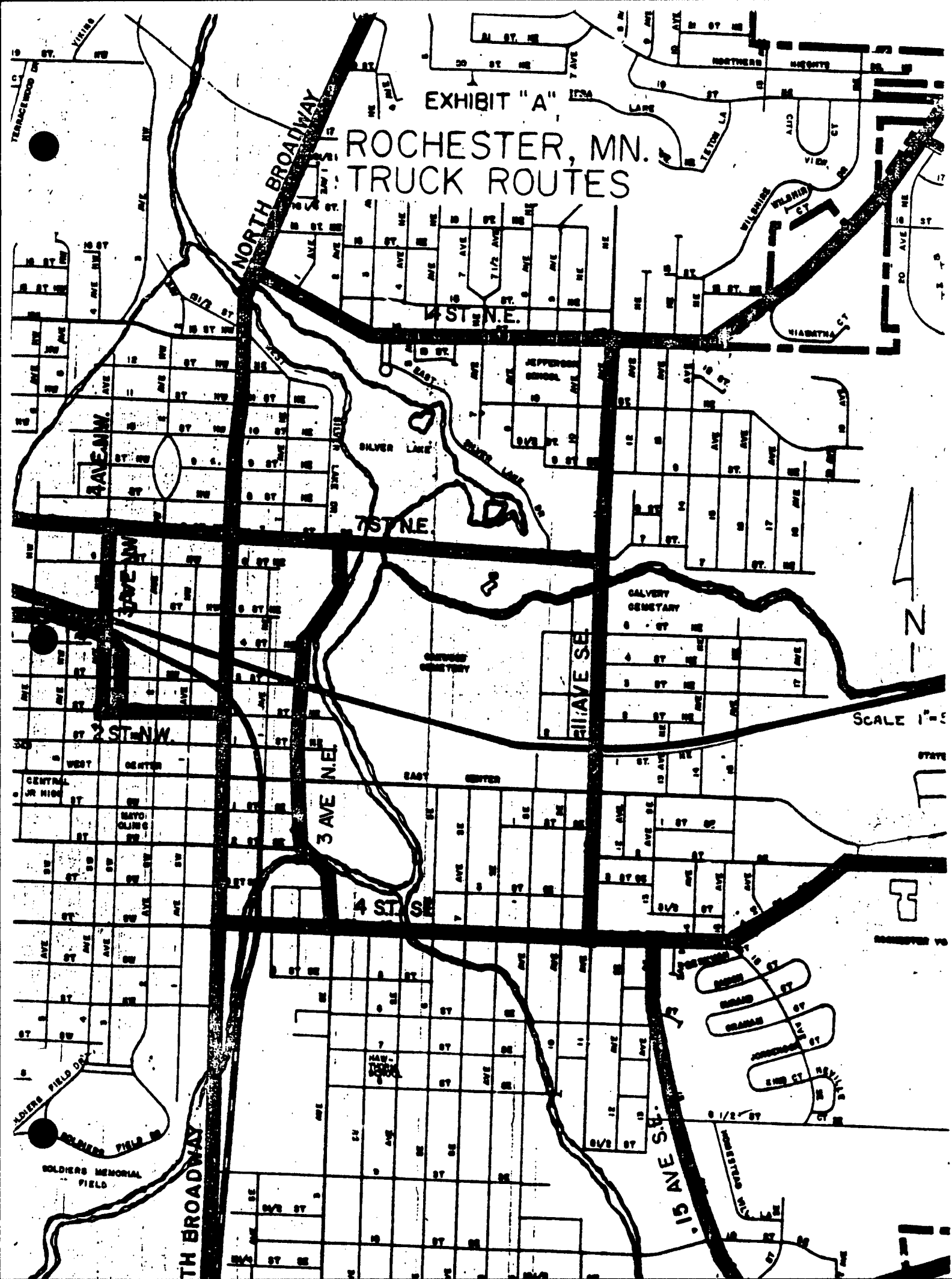
2) Hammond Quarry located 12.8 miles north on Highway 63 from Broadway Street bridge and two miles east on C.S.A.H. 11 on the north side of the road.

Further testing of the quarries is needed to determine acceptability by the Corps of Engineers. Both quarries have been tested by the Minnesota Department of Transportation and have passed their specifications.

Refer to Exhibits B & C which show quarry locations.

9. CONTAMINATED SOILS

Contaminated soils were identified on the left bank just upstream of the Dakota, Minnesota and Eastern Railroad bridge at station 174+50. Alternate bank protection than the sheet pile wall with concrete deadman proposed in the FDM will be designed during plans and specifications to minimize soil excavation.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ROCHESTER, MN.
TRUCK ROUTES
NORTH BROADWAY
4 ST N.E.
7 ST N.E.
4 AVE N.W.
3 AVE N.W.
2 ST N.W.
11 AVE S.E.
3 AVE N.E.
4 ST. S.E.
15 AVE S.E.
SILVER LAKE
SILVER LAKE
SOLDIERS MEMORIAL FIELD
SOLDIERS FIELD DR.
CENTRAL JR HIGH
MAYO CLINIC
WEST CENTER
EAST CENTER
CALVARY CEMETARY
OAKWOOD CEMETERY
JEFFERSON SCHOOL
HAWTHORNE ADDN
NORTHERN HEIGHTS
SCALE 1"=

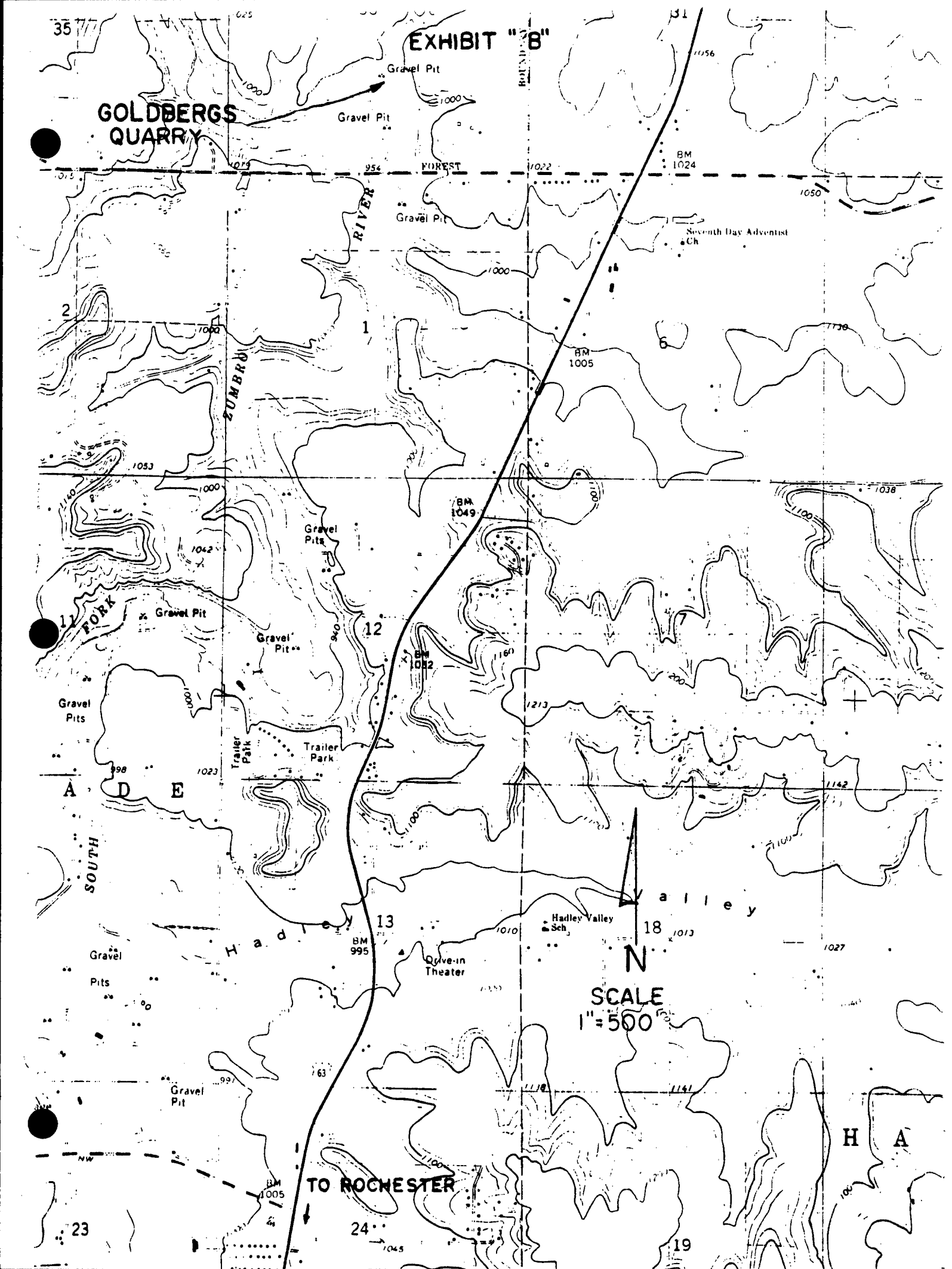


EXHIBIT "B"
GOLDBERGS QUARRY
Gravel Pit
Gravel Pit
Gravel Pit
FOREST
BM 1024
Seventh Day Adventist Ch
ZUMBRO RIVER
BM 1005
BM 1049
Gravel Pits
SOUTH FORK
Gravel Pit
Gravel Pit
BM 1032
Gravel Pits
Trailer Park
Trailer Park
A D E
Hadley Valley
Hadley Valley Sch
BM 995
Drive-in Theater
Gravel Pits
Gravel Pit
N
SCALE
1" = 500'
TO ROCHESTER
H A
35
2
1
6
11
12
13
18
23
24
19

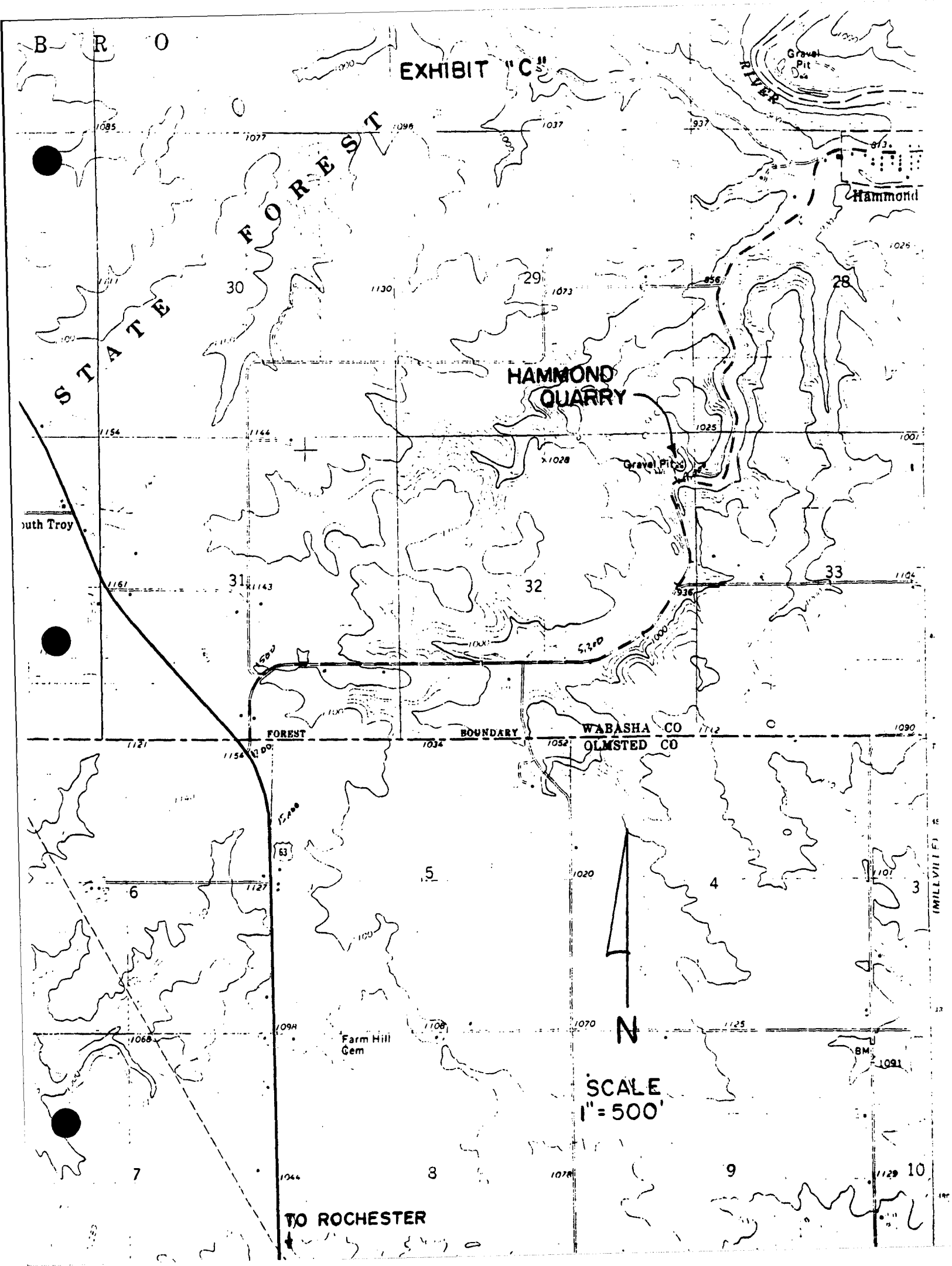


EXHIBIT "C"
STATE FOREST
HAMMOND QUARRY
Gravel Pit
Hammond
RIVER
South Troy
FOREST BOUNDARY
WABASHA CO
OLMSTED CO
Farm Hill Cem
TO ROCHESTER
N
SCALE
1" = 500'

LAST UPDATE
18-NOV-1988
CONS1.w20

CONSTRUCTION SCHEDULE
ROCHESTER STAGE 1B, FEATURE DESIGN MEMORANDUM

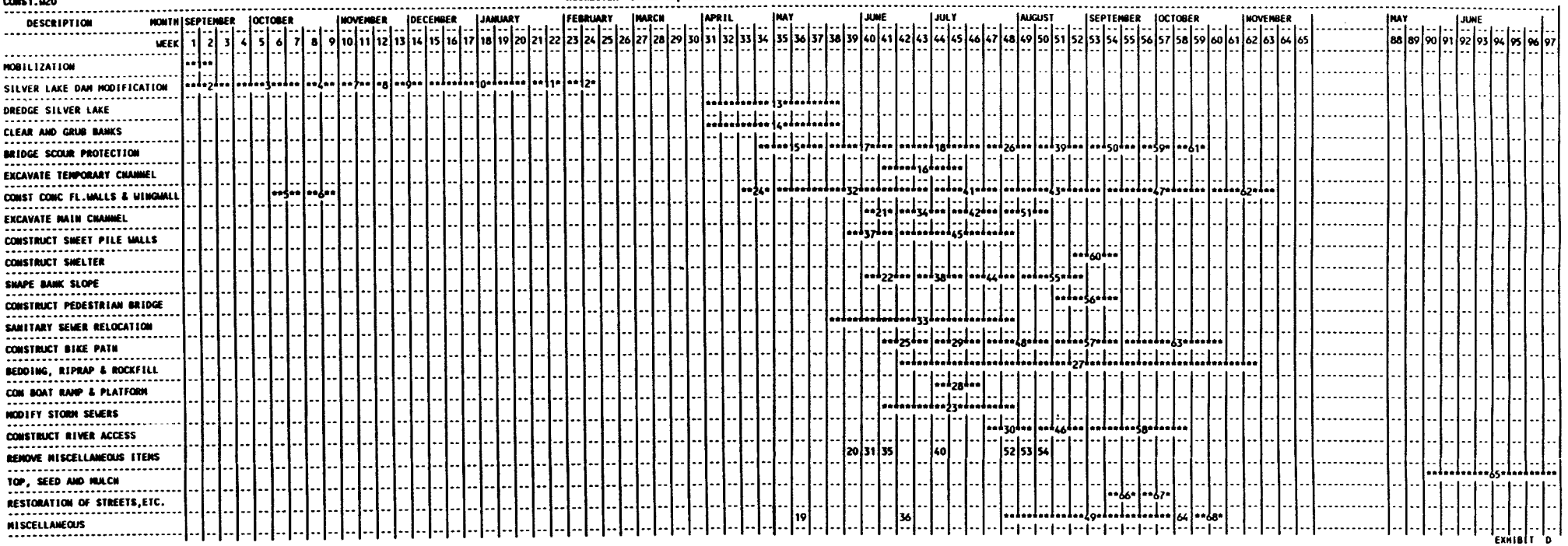


EXHIBIT D

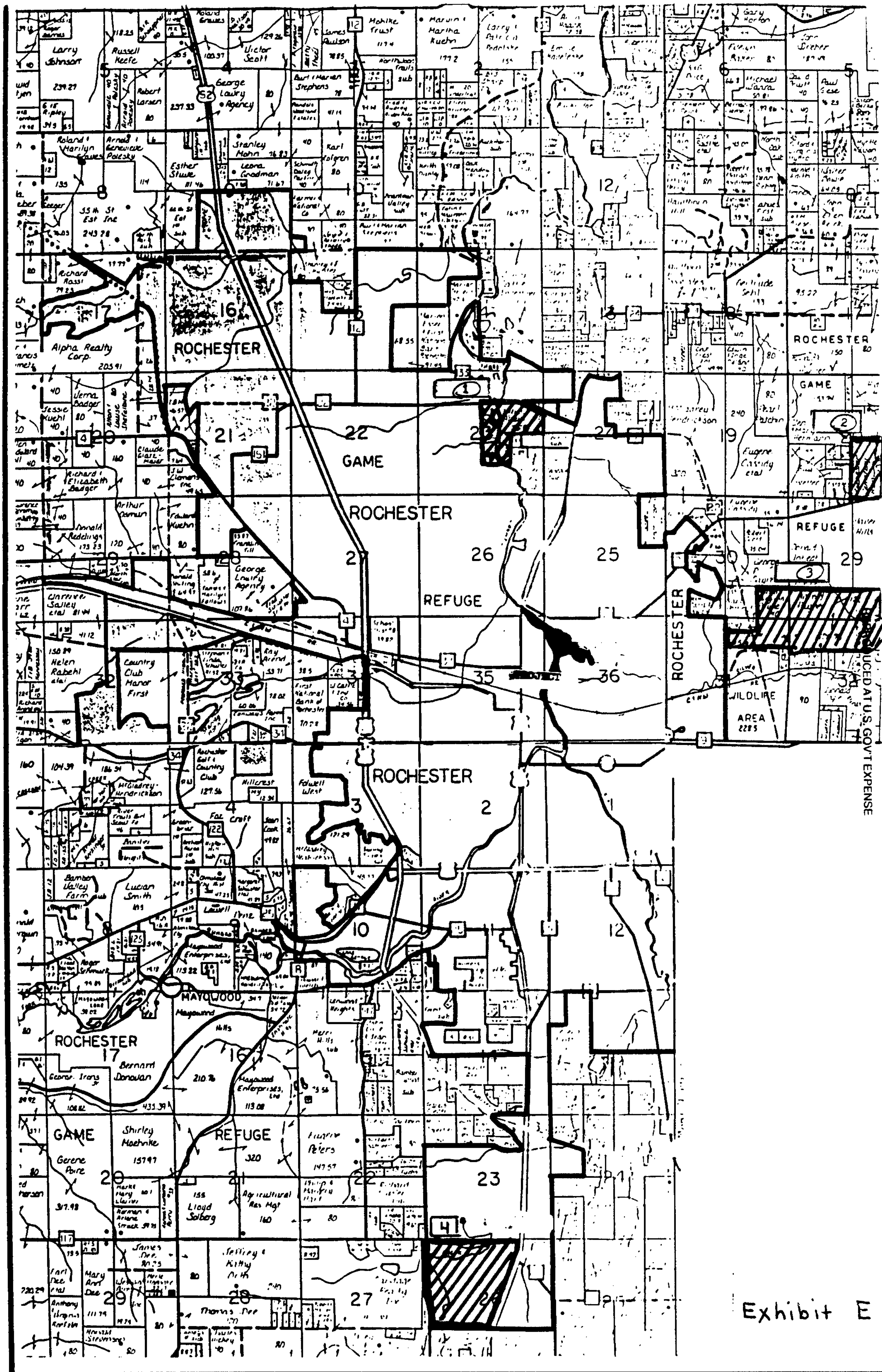


Exhibit E

DESIGN MEMORANDUM NO. 2
FLOOD CONTROL SOUTH FORK ZUMBRO RIVER
ROCHESTER, MINNESOTA
STAGE 1B SUPPLEMENT

APPENDIX F
RECREATION, LANDSCAPE DEVELOPMENT, AND AESTHETIC CONSIDERATIONS

APPENDIX F

RECREATION, LANDSCAPE DEVELOPMENT, AND AESTHETIC CONSIDERATIONS

RECREATION

1. Recreational opportunities will be enhanced with the construction of a multi-purpose asphalt trail, four river access landings, and two small riverside plaza areas. Additional facilities provided will include a trail shelter, a pedestrian/bicycle bridge, and a small visitor parking lot. Existing recreation facilities (shelters, swimming pool, play equipment, etc.) at Silver Lake Park and Mayo Memorial Park will not be directly affected by the flood control project construction.

2. A bicycle trail has been incorporated into the project as a cost-shared recreation feature. The trail is an 8-foot-wide asphalt-surfaced link between existing trail segments. The trail system will receive both recreational and bicycle commuter use. In addition, the trail will provide a maintenance access road for the flood control project.

3. The right bank trail begins in Silver Lake Park at 7th Street N.E. The trail crosses Silver Creek on an existing pedestrian bridge and continues upstream to an underpass at the Center Street Bridge. From Center Street, the trail continues to 4th Street S.E. The trail follows 4th Street S.E. and uses the street bridge to cross Bear Creek. A new trail follows the left bank of Bear Creek downstream to the Zumbro River and continues upstream along the river to the stage limits at 3rd Avenue S.E.

4. The trail segments from 7th Street N.E. to station 165+00, station 169+00 to 177+50, and station 194+00 to 4th Street S.E. are located above the top of wall elevation. The trail is positioned at an intermediate level below a concrete floodwall and above the riprap slope from station 165+00 to 169+00 and from station 177+50 to 194+00. A trail underpass is included in the project at the 7th Street N.E. bridge and the Center Street bridge. An at-grade crossing is used at the railroad tracks at station 175+00. The trail has a street level access at station 187+50.

5. A left bank trail links with an existing city trail and sidewalk at 2nd Street N.E. and continues upstream through Mayo Memorial Park. The left bank trail is located at the top of the existing and proposed floodwalls and has an at-grade crossing at Center Street.

6. The trail and details have been designed in accordance with EM 1110-2-410, Design of Recreation Areas and Facilities - Access and Circulation, Department of the Army, 31 December 1982.

7. River access structures will be located adjacent to the trail at stations 160+80L, 176+00L, 195+20R, and 196+00L. The structures will consist of a top-of-bank staging or overlook area, river access stairs, intermediate level landings, and a water's edge landing. The

concrete river accesses delineated on the plan and profile drawings are illustrative in nature and do not represent the final design configurations. Conceptual plans of the access points and the overlook landings will be developed by the Government prior to initiation of plans and specifications. Handicapped accessibility to the water's edge landings will be provided, if practical. The overlook or staging areas above each of the river access points will be fully accessible. At least one of the river access structures will provide handicapped accessibility to the waters edge.

8. The river access point at station 160+80L will provide river access from a small 10-to-15 car drive-through parking lot. The small parking lot will provide parking for fishing access and serve as a minor trail head for bikers and pedestrians. A small top-of-bank concrete landing will function as a staging area for trail and river access and as a rest area and overlook. The rivers edge landing will be designed for fishing use.

9. A river access point and overlook area is shown on the plan and profile drawings near station 176+00. Access to the landing area is from parking stalls on 2nd Street N.E. and from the left bank project trail. This access will be moved upstream to 1st Street N.E. because of contaminated soils at the 2nd Street N.E. site. This is a minor river access area and the river landing will be sized accordingly. The top-of-bank landing area will function more as a staging area or rest stop than as an overlook with a river vista.

10. Two river access areas and a pedestrian bridge are designated for Mayo Memorial Park. The areas are delineated on the plan and profile at stations 195+20R and 196+00L. The access at station 195+20R is across the Zumbro River from the Civic Center and includes a park/trail shelter. The left bank access at station 196+00 provides for a larger top-of-bank plaza area than the three other access areas for this project stage. A second small plaza area will be designed for the space between the city art center building and the top-of-wall project path. An existing brick surface patio area at this location will be disturbed by channel improvement construction.

11. The existing radial forms of the Civic Center Building, the marble amphitheater, entrance drive, parking lot, and river channel suggest the use of curved rather than angular forms for the river access landing and landscape development. The landing for the proposed pedestrian bridge should be incorporated into the top-of-bank staging areas for the left and right bank river accesses. Designing these as separate elements misses an opportunity to unify the design and would fragment these riverfront amenities. The left bank river access plaza should be sited between the proposed top-of-wall and the existing bituminous park path and sized to be subordinate in scale to existing park structures.

AESTHETICS

12. Much of the existing riverbank through the Stage 1B reach is vegetated and has a naturalized appearance. Other existing shoreline conditions are found intermittently through the reach and include concrete fabriform, sheet pile walls, riprap, stone walls, and concrete walls. Although the shoreline elements vary, existing top of bank vegetation provides an element of visual continuity.

13. Further review of shoreline protection alternatives was done in response to City of Rochester concerns relating to project aesthetics. The areas of most concern were the Mayo Memorial Park riverfront and the view from 2nd Avenue N.E. between station 170+00 and 7th Street N.E. Use of sheet pile and concrete floodwalls with a riprap lower slope has satisfied concerns over the aesthetic acceptability of the previously proposed riprap slopes in Mayo Memorial Park. Recreation paths have been incorporated into the bank protection cross section on the left and right bank of the Zumbro River at Mayo Memorial Park. The right bank path is located at an intermediate level above the riprap slope and below a concrete floodwall. The left bank path is positioned at the top of a concrete capped sheetpile wall or a concrete floodwall.

14. Incorporating the paths into the bank protection maintains a level of river awareness for the user that would have been adversely affected by riprap protection alone. Tying the paths to the bank protection also helps bond the walls to the park as a compatible architectural element rather than a structured intrusion. Architectural wall treatments will be designed during the development of plans and specifications. Additional visual compatibility is provided by the top-of-wall guardrail design that will be used throughout the project for visual continuity. Guardrails are used in public use areas or where the path is adjacent to the wall; other areas will use black vinyl coated chainlink fencing.

15. A landscape development plan has not been completed for the 1B FDM. A landscape development "typical" has been included in the plan plates to illustrate the type of landscape plan that will be completed during plans and specifications. The landscape development plan is intended to add visual interest and compensate for the riverbank vegetation loss. Proposed landscape plantings will be designed to add visual diversity and interest while not barring or physically restricting views of the riverfront.

COORDINATION

16. Design modifications addressing aesthetics have been coordinated with the City of Rochester and their design consultant. The design changes incorporated in this FDM supplement address the concerns over the project's visual effects and have been endorsed by the appropriate city officials and committees. Copies of correspondence relating to aesthetics and recreation features are included in Appendix G.

APPENDIX G

CORRESPONDENCE

APPENDIX G

TABLE OF CONTENTS

City of **ROCHESTER**

Minnesota

September 16, 1988

GARY H. NEUMANN
Assistant City Administrator
Room 214, City Hall
Rochester, MN 55902-3129
(507) 285-8082

Deb Foley
St. Paul District-Army Corps of Engineers
1135 U.S. Post Office and Customs House
St. Paul, Minnesota 55101-1479

RE: CITY COUNCIL DECISIONS/STAGE 1B AESTHETIC AND RECREATION ITEMS

Dear Deb:

The City Council reviewed the Stage 1B plans at their meeting on September 7, 1988. I will describe the decisions made at that meeting. The Council followed the list of items dated September 1, 1988, which was provided by BRW. The costs utilized in that memo may not match the Corps' estimates, but were utilized to assist the Council in arriving at a decision.

I will start with the items which the Council agreed to delete first. The first of these is not included in the September 1, 1988, list provided by BRW as it was previously recommended for deletion.

DELETIONS

1) Floodwall/Station 177+50R to 184+76R

The wall by the Park Department building was deleted. The trailway/bikeway in this area should be on top of the bank. A short section of floodwall adjacent to the Park Department building is needed to move the path away from the building, but this would be a short section of wall.

2) Overlook/River Access and Bikepath From Station 176+00L to 184+00L

The bikepath and recreational improvements from station 176+00 to 184+00 on the left side were deleted. These are listed as items 17 and 18 in the BRW 9/1/88 list.

ITEMS TO BE INCLUDED IN STAGE 1B PLANS

FLOODWALLS/CHANNELIZATION CHANGES

1) 184+75L to 202+90L

A concrete wall is proposed from Center Street to the 3rd Avenue Bridge. The wall height is as shown in the current plans. One revision should be noted. A concrete wall is requested behind the Art Center instead of a sheet pile wall.

2) 187+45R to 193+45R

A concrete floodwall is proposed to be designed as shown in the current plans.

3A) 197+50R to 204+00R

The City is requesting that turf be placed over the rip rap in this area down to either the 5 or 10 year flood elevation. The specifics of this design still need to be worked out between the Corps and the City. The City would like a flat grass area immediately adjacent to the top of the exposed rip rap to allow for close proximity to the channel. A concrete floodwall in this location was rejected.

4A) 165+15R to 169+05R

The City is requesting that turf be placed over the rip rap in this location down to either the 5 or 10 year flood elevation (specifics to be discussed further). A concrete floodwall in this location was rejected.

FLOODWALL GRAPHICS

1) 194+50L TO 195+50L

The Council agreed to utilize a wall motif in this area. The specifics of the motif still need to be finalized by the City.

2) All Other Walls - Formed Ribs

The Council agreed to utilize formed ribs in all the other concrete wall surfaces. A specific formed rib design will be provided by the City.

HANDRAILS

The City agreed to utilize the BRW designs for handrails, similar to Stage 1A2B.

BRIDGE UNDERPASSES - (all should be included)

1) 7th Street Right Bank

2) 3rd Avenue Right Bank - This item may be in Stage 2A and may be subject to some additional review.

3) Center Street Right Bank

4) 3rd Avenue Left Bank - This item may be in Stage 2A and may be subject to some additional review.

FEATURES - (all on September 1 list should be included)

1) Civic Center River Access - The specific design of this access and the floodwall adjacent to the Civic Center should follow the site plan prepared by BRW which has previously been provided to the Corps.

2) Mayo Park River Access - The specific design for this will be provided by BRW.

3) 7th Street River Access and Parking - This should be included, but will be redesigned by BRW.

4) Park Department Wall - This short section of floodwall is intended simply to move the path which will now be at the top of the bank away from the Park building just in the immediate area of the building.

5) Civic Center Pedestrian Bridge - This should be included. The location of the bridge should be changed and should follow the BRW plan and utilize the Civic Center River Access and the Mayo Park River Access as touchdown points.

6) Bike Paths - With the exceptions noted previously, the bike paths should follow the alignments shown in the plans. The primary exceptions noted were the deletion of a bike path from Center Street to 2nd Street N.E. on the west side, the fact that paths in the Civic Center area should correspond to BRW's site plan, and the change in the Park Department building area bikepath to the top of the slope. An effort should be made to meander the bike paths to add some character to them as opposed to straight lines.

This letter relates to recreational and aesthetic items in Stage 1B. The Public Services and Public Utilities Departments may need to further review the construction details. One item which should also be revised is the truck landing and access point behind Fire Station No. 2. I previously sent you some information from the Fire Department which would allow a scaling down of this landing/access.

A decision on the type of lighting still needs to be decided by the Council. This will be a standard catalog item which should be easy to incorporate.

If you have any questions, please call.

Sincerely,

Gary H. Neumann
Assistant City Administrator

GHN:kmh

cc: Roger Plumb
Curt Taylor
Denny Stotz
Doug Knott
Jon Harford
Harold Skjelbostad

ROCHESTER FLOOD CONTROL PROJECT
STAGE 1B
RECOMMENDED IMPROVEMENTS
September 1, 1988

AESTHETIC COSTS

Flood Walls

Deletions Final

Plan I.D. Number	Priority	Station	Unit Cost	Total Cost	L.F.
1	1	184+75L to 202+90L (COE design plus concrete wall in lieu of sheet pile wall south of Center St. bridge)	$849/LF	$1,540,935	1,815
2	2	187+45R to 193+45R	758	454,998	600
3	3	197+50R to 204+00R- concrete wall	500	325,000	650
	3A	197+50R to 204+00R- turf on riprap	50	32,500	650
4	4	165+15R to 169+05R	414	161,319	390
	4A	165+15R to 169+05R- turf on riprap	50	40,000	80C
		Subtotal for flood walls (1,2,3,4)		$2,482,252	
		Subtotal for flood walls and turf on riprap (1,2,3A,4A)		2,068,433	
		Less riprap at flood wall locations (revised design)		178,315	
5		Less sheet pile walls south of Center St.		109,475	
		Total for flood walls (1,2,3,4)		$2,194,462	
		Total for flood walls and turf on riprap (1,2,3A, 4A) plus $54,000 of deleted riprap from above		1,834,643	
6		(Alternative One - Increase wall height from station 184+75L to 202+90L at $1,200/LF which equals $2,178,000 in lieu of $1,540,935. Add $637,065 to total for flood walls)		(637,065)	

Flood Walls Graphics

	Priority	Station	Unit Cost	Total Cost	L.F.
7	1	194+50L to 195+50L	$120/LF	$ 12,000	100
	2	All other walls- formed ribs	20	81,600	4,080
		Total for flood walls graphics		$ 93,600	

Handrails/Fences

		Costs in excess of $50/LF		$ 91,241	

Subtotal Cost for Aesthetics (with flood walls 1,2,3,4)	$2,379,303
Subtotal Cost for Aesthetics (with flood walls and turf on riprap 1,2,3A, 4A)	2,019,484
Less COE participation in aesthetics	540,000
Total Cost for Aesthetics (with flood walls 1,2,3,4)	$1,839,303
Total Cost for Aesthetics (with flood walls and turf on riprap 1,2,3A, 4A)	$1,479,484

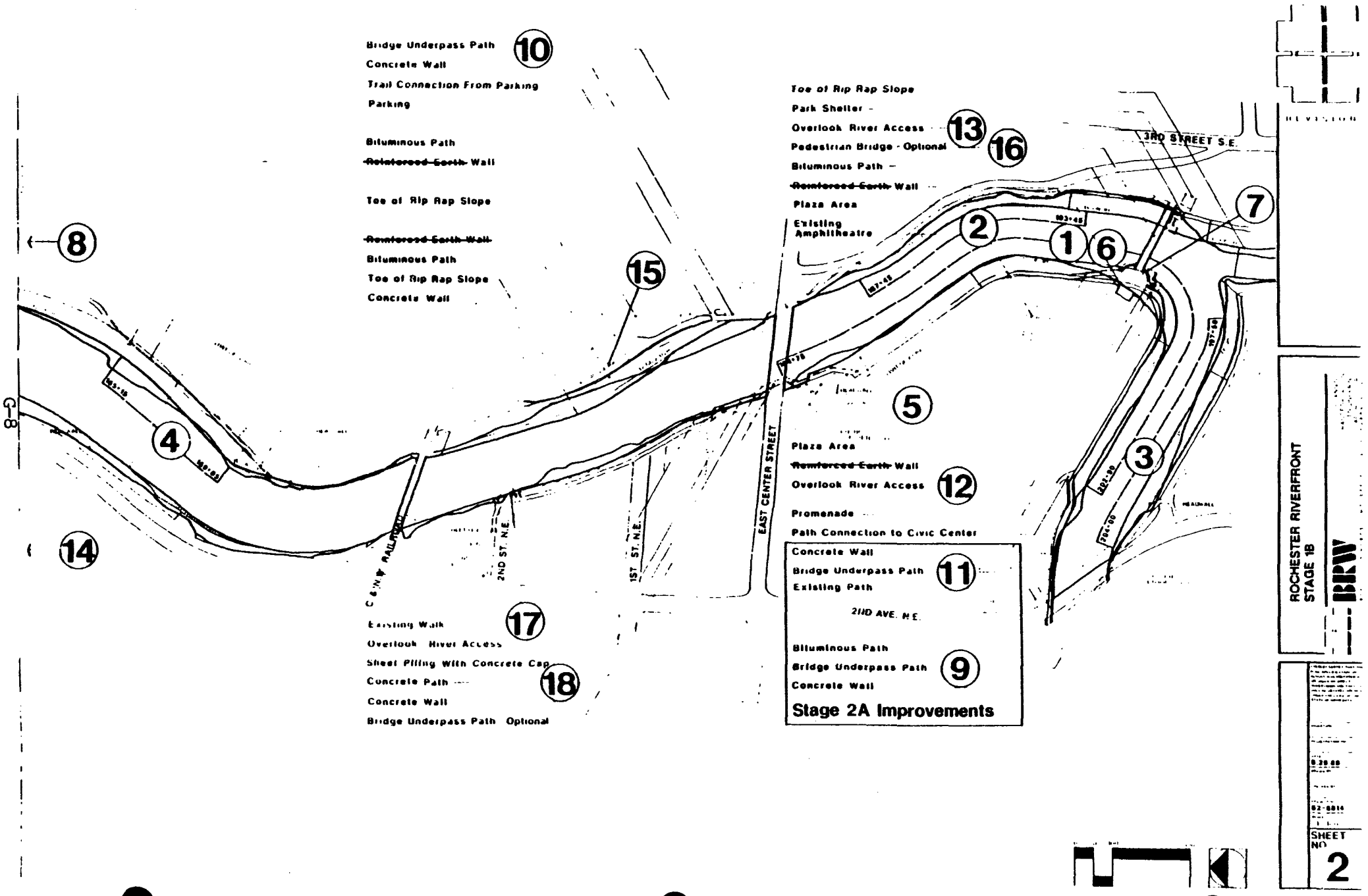
RECREATION COSTS

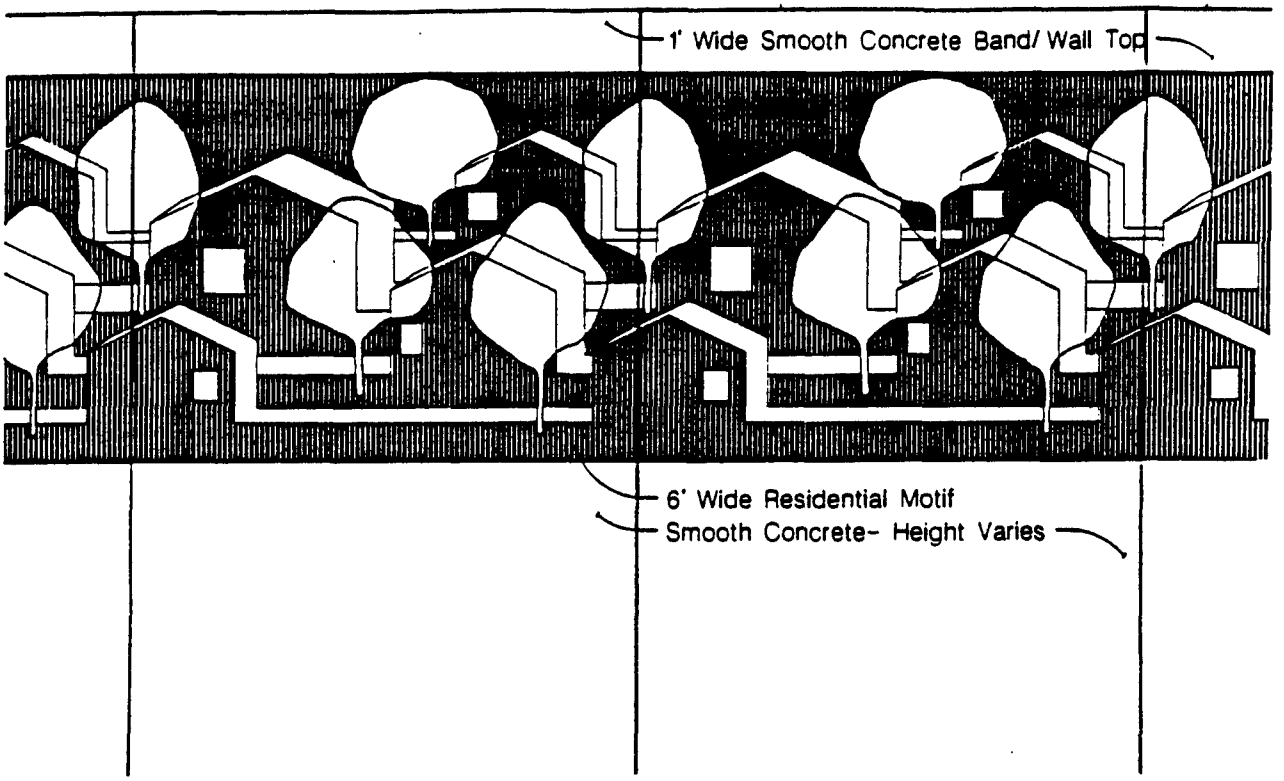
Bridge Underpasses

Plan I.D. Number	Priority	Station	Unit Cost	Total Cost
8	1	7th Street- Right Bank		$128,000
9	2	3rd Avenue- Right Bank		70,350
10	3	Center Street- Right Bank		212,000
11	4	3rd Avenue- Left Bank		70,350
	Total for bridge underpasses			$ 480,700

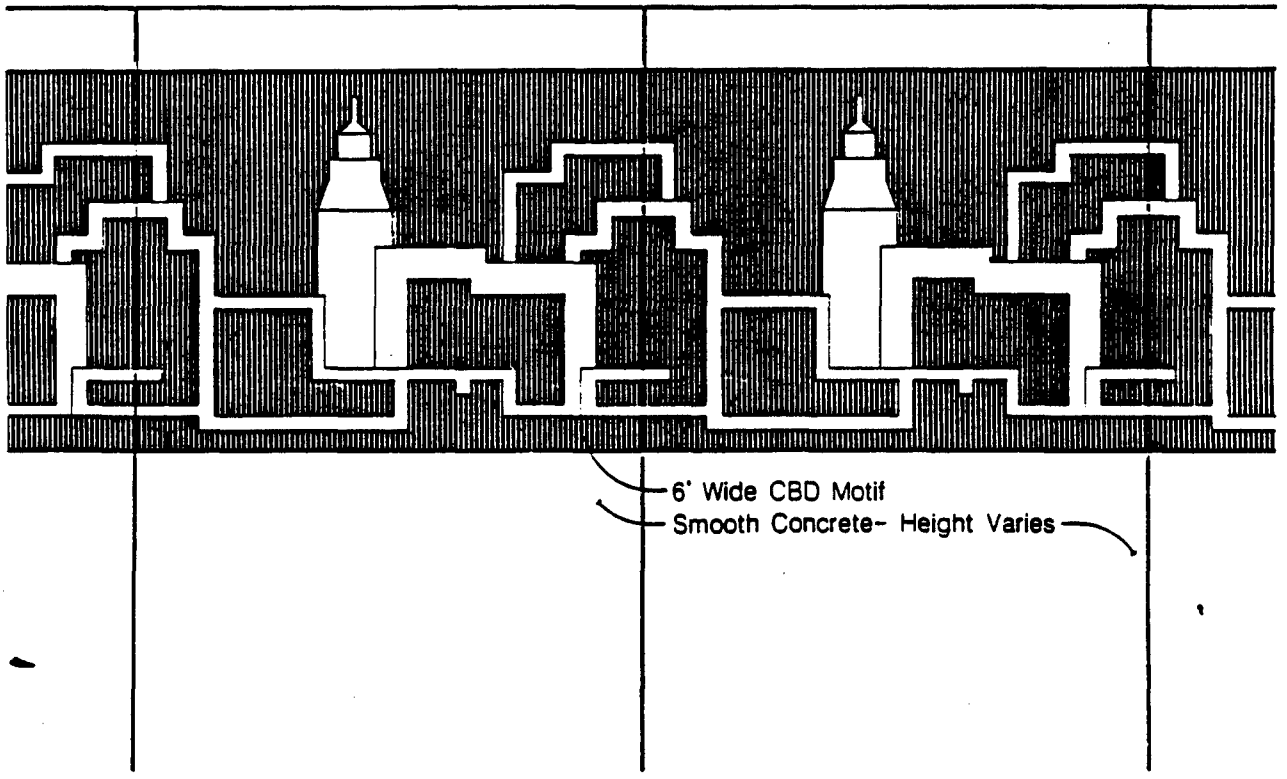
	Priority	Feature	Total Cost
12	1	Civic Center River Access	$105,500
13	2	Mayo Park River Access	31,000
16	4	Redesigned 7th Street River Access and Parking	32,000
14	5	Parks Department Wall	20,000
15	3	Civic Center Pedestrian Bridge	220,000
	NA	Bike Paths	354,700
	NA	Lights/ Electrical	110,500
	Total for recreation		$ 873,700
17	Less overlook and river access at Station 176+00L		N/A
18	Less bike path from Station 176+00L to 184+00L		N/A
	Total Cost for Recreation Features		$ 873,700

Subtotal Cost for Recreation	$1,354,400
Less COE Share of Recreation Costs - 50%	677,200
Total Cost for Recreation	677,200
Total City Costs for Aesthetics and Recreation (with flood walls 1,2,3,4)	$2,516,503
Total City Costs for Aesthetics and Recreation (with flood walls and turf on riprap 1, 2, 3A, 4A)	$2,156,684





Right Bank Floodwall Elevation

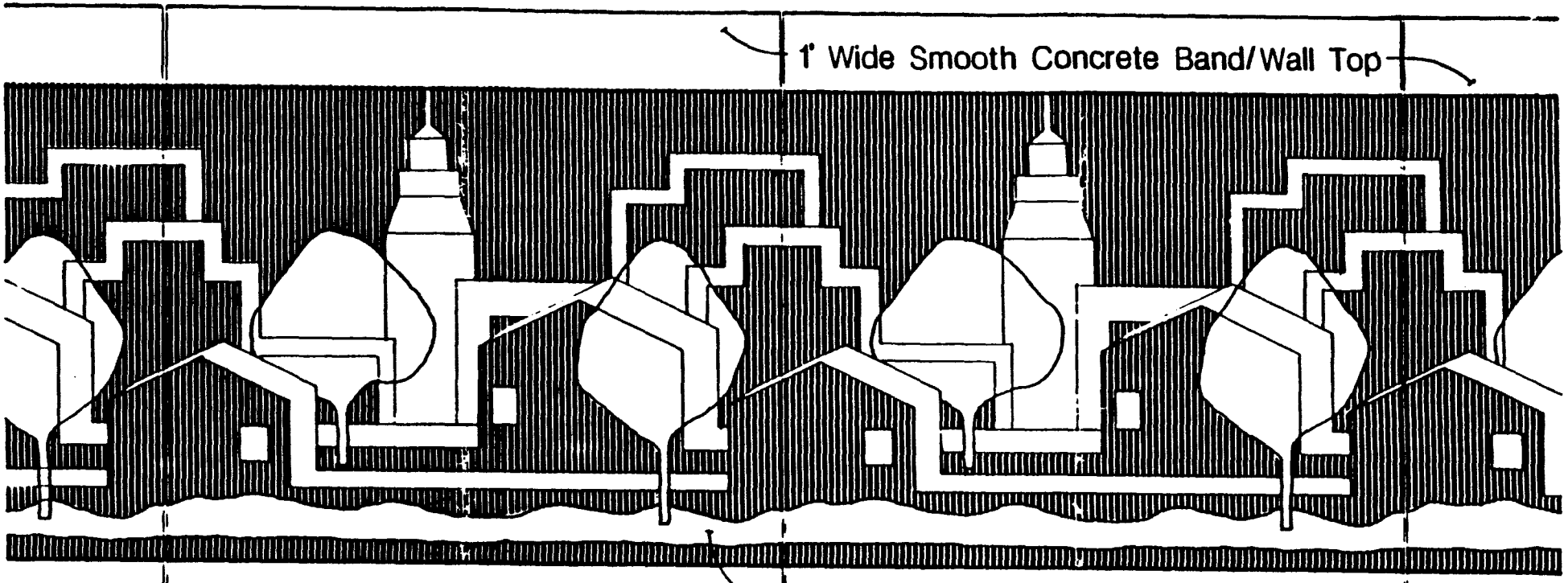


Left Bank Floodwall Elevation

Floodwall Alternatives

Scale: 1/2" = 1'-0"
June 6, 1988

BRW



Right and Left Bank Floodwall Elevation

Floodwall Alternati

Scale: 1/2" = 1'-0"

BRW

Copy Roger
Curt Taylor
Deb Hurley
Reference: Stage 13 Plans

M E M O R A N D U M

City of Rochester Fire Department

August 30, 1988

TO: Gary Neumann

FROM: Assistant Chief Stutz

SUBJECT: FLOOD CONTROL PLANS
BOAT RAMP & PUMP TESTING SLAB

After reviewing the plans for the area behind Fire Station #2, it appears that both the boat ramp and slab are much larger than the needs of the Fire Department.

The boat ramp is constructed of two rows of concrete plank placed side by side. Each is 12 feet wide. One row 12 feet wide would meet our needs. An engine is 8 feet wide. The 12 foot width would leave 2 feet on each side for walking past the truck.

The concrete pump testing platform is 24 feet wide and approximately 84+ feet long. Our longest engine is 30 feet long. A concrete slab of 12 feet wide and 36 feet long would meet our needs.

I think it is important that a boat ramp is placed somewhere on the lake. It must have good access with pavement and be kept plowed in the winter.

It is not necessary to have the pump testing platform behind the station, but it would be convenient both for testing the pumps and for giving the promotional exam for Motor Operator. Another possibility for a location would be Foster Arends Park, but a concrete slab would also need to be built at that location.

D. File
ED-M

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
1135 U.S. POST OFFICE & CUSTOM HOUSE
ST. PAUL, MINNESOTA 55101-1479

July 29, 1988

REPLY TO
ATTENTION OF
Project Management
Engineering

Mr. Gary Neumann
Assistant City Administrator
City Hall, Room 214
Rochester, Minnesota 55902

Dear Mr. Neumann:

During preparation of the supplement to the FDM (Feature Design Memorandum) for Stage 1B of the Rochester flood control project, the city asked for additional aesthetic and recreational features. The changes made are described in the preliminary copy of the supplement provided to you on May 23, 1988. This letter provides a breakdown of the costs associated with the aesthetic and recreational features.

Modifications for aesthetics consist of replacing riprap slope protection at four locations with flood/retaining walls and including a handrail/fence design that is more costly than the standard fence we use. The difference between the construction costs for each of the walls and the costs for the original riprap slope design is considered to be an aesthetic cost. Estimated costs for engineering and design have been added to determine the total costs for these aesthetic improvements. The total aesthetic cost for the four walls is $2,454,549; these costs are detailed in the enclosure. These costs do not include the costs of architectural treatment for the floodwalls.

During past meetings concerning Stage 1B, the Corps and the city agreed that handrail/fence costs exceeding $50 per linear foot would be considered an aesthetic cost. The total cost for handrail in excess of $50 per linear foot was estimated at $91,421.

The total cost for aesthetic improvements is estimated to be $2,545,790. In our October 29, 1987, letter, we stated that up to $720,000 would be allowed as a total project cost for aesthetic improvements in Stage 1B. The remaining $1,825,790 is the cost of betterments and is entirely the city's cost, in addition to all of the cost-shared project costs.

In addition to the aesthetic improvements, several recreation features have been added to the design of Stage 1B. The costs of these features, which are also presented in the enclosure, have increased the city's recreation costs from $181,000 (February 1987 FDM costs adjusted to October 1988 price levels) to an estimated $727,000.

Before we begin work on the plans and specifications for this stage, we must know which of the aesthetic and recreation features the city feels should be included in the final project design. To avoid delays, we must have the city's final decision by August 31, 1988.

Please contact the project manager, Ms. Deborah Foley, at (612) 220-0430 if you have questions.

Sincerely,

Robert F. Post
Chief, Engineering Division

Enclosure
Cost details

ROCHESTER FLOOD CONTROL PROJECT
STAGE 1B

AESTHETIC COSTS

Floodwalls

Station	Total cost (Construction and E&D Cost)
165+15R to 169+05R	$161,319
177+50R to 184+76R	569,414
186+20L to 202+90L	1,417,883
187+45R to 193+45R	454,998
	2,603,614
Estimated cost for riprap slope protection at floodwall locations (as given in February 1987 FDM)	149,065
Aesthetic costs for floodwalls	2,454,549

Handrails/fences

Costs in excess of $50 per linear foot	91,241

Total aesthetic costs

Floodwalls	2,454,549
Handrails/fences	91,241
Cost-shared aesthetic costs	720,000
Total city costs for aesthetic measures	1,825,790

RECREATION COSTS

Feature	
Bike paths and underpasses	796,657
Pedestrian bridge	220,076
River accesses, plazas, overlooks	327,065
Electrical	110,500
Total recreation costs	$1,454,298
Total city costs for recreation	$727,149

Enclosure 1

City of **ROCHESTER**

Minnesota

January 20, 1988

GARY H. NEUMANN
Assistant City Administrator
Room 214, City Hall
Rochester, MN 55902-3129
(507) 285-8082

Deb Foley
St. Paul District-Army Corps of Engineers
1135 U.S. Post Office and Customs House
St. Paul, Minnesota 55101-1479

RE: REVISED BRW MAPS/STAGE 1B

Dear Deb:

The staff involved in the review of the amenity plans for Stage 1B have reviewed the revised drawings provided by BRW. The revised plans do accurately reflect the discussions of the City Council on the plans for this stage. The staff would mention four minor revisions or potential changes to the plan which should be included with the work to be done by the Corps consultant, WHKS.

1) RPU Area/West Side

BRW's plan has moved to overlook to station 160+00 which is per the Council's review. One suggestion of the staff is to incorporate a small parking area into the plan prepared by BRW at about station 159+00. This may allow greater utilization of the overlook/fishing access.

2) RPU Area/East Side

The BRW plan and cost estimate includes 510 feet of a lower path which requires a 6 foot high reinforced earth wall. If the costs appear too high, we may recommend that the length of this wall be reduced by 100-200 feet.

3) Mayo Park Area/West Side

The BRW plan correctly shows an underpass under the west side of the Center Street bridge. If this underpass is later found to be non-feasible, the path should be shown as having a connection to the sidewalk on the south side of the Center Street bridge.

4) RPU Area/West Side

The Fire Department has some concerns regarding access to the water and a testing area for pumper trucks behind Fire Station No. 2. The comments of the Fire Department are attached. A meeting should be arranged between WHKS and the Fire Department to review their needs. This can be arranged by this office.

If the Corps or WHKS has any questions, please feel free to contact me. We look forward to working with the Corps and WHKS on the Stage 1B plans.

Sincerely,

Gary Neumann
Assistant City Administrator

GN/kas
attachment

cc: Stevan Kvenvold
Roger Plumb
Curtis Taylor
Denny Stotz
Douglas Knott
David Olson
Gunnar Isberg
John Harford
Chief Mertz
Harold Skjelbostad
Dick Kastler

copy to Roger Olson, Curt Taylor, Harold Shellberg, Ray Latter, Det Div

City of ROCHESTER

Minnesota

ORVILLE N. MERTZ, Chief
Rochester Fire Department
521 South Broadway
Rochester, MN 55904-6406
(507) 285-8072

December 18, 1987

TO: Gary Neumann

FROM: Orville Mertz

SUBJECT: CORPS OF ENGINEERS STAGE 1B PLANS

In addition to a boat launching access to Silver Lake, we also need a pump testing platform close enough and low enough so that we may test our pumpers from draft. Pumps are tested at least once annually. There is now a concrete platform, next to the river, from which we position our trucks for this test.

The location of an access and pump testing area is not critical, however, it is essential that some location for these two items be made somewhere along Silver Lake. The present location is highly desirable for us and we would like to retain them, if possible. The pump testing/area should have a higher priority than boat launching. The area in back of Station 2 is also our drill grounds. We would like to retain as much of this area as is possible.

ms D Foley
ED-H

DEPARTMENT OF THE ARMY
ST PAUL DISTRICT, CORPS OF ENGINEERS
1135 U.S. POST OFFICE & CUSTOM HOUSE
ST. PAUL, MINNESOTA 55101-1479

October 29, 1987

REPLY TO ATTENTION OF
Project Management
Engineering Division

Mr. Gary Neumann
Assistant City Administrator
City Hall
Rochester, Minnesota 55902

Dear Mr. Neumann:

On August 25, 1987, Ms. Deborah Foley from the St. Paul District met with you to discuss cost sharing for the aesthetic improvements that the city of Rochester has proposed for the flood control project in the Mayo Park area. At that meeting, you asked us to provide the city with a written statement of the costs that we would consider eligible for cost sharing for these aesthetic improvements.

Typically, the costs for aesthetic improvements, up to a maximum of 3 percent of the project costs, may be included as part of the total flood control project costs. Under special circumstances, past policy has allowed double this amount. We feel that stages 1B and 2A warrant special consideration because of their location in the downtown area and because of the existing and proposed uses for these areas. For these reasons, the District has determined that costs attributable to aesthetic improvements in these two reaches, up to a maximum of 6 percent of the construction costs, should be allowed as project costs. Thus, they would be subject to Federal/non-Federal cost sharing as flood control features. The additional project cost for aesthetic treatment for stage 1B is estimated as $720,000; allowable aesthetic costs for stage 2A are estimated as $900,000. For stages 2B, 3, and 4, we would allow up to the typical additional costs for aesthetic improvements of 3 percent of the construction costs for each stage, currently estimated at $210,000, $180,000, and $240,000, respectively. Any costs for aesthetic measures desired by the city that exceed these maximums would be treated as betterments as defined under the provisions of the local cooperation agreement.

All project costs attributable as recreation costs will be shared on a 50-50 basis, as prescribed by the Water Resources Development Act of 1986 (Public Law 99-662).

Our current project schedule requires the city to finalize its decision on aesthetic improvements to be included in stage 1B by November 16 so that the aesthetic improvement supplement to the feature design memorandum may be completed by February 1988.

Please contact the project manager, Ms. Deborah Foley, at (612) 725-5933, if you have additional questions concerning this matter.

Sincerely,

Robert F. Post
Chief, Engineering Division

January 23, 1987

Rochester, Minnesota 55901

Chuck Hazama
Mayor

Colonel Joseph Briggs, District Engineer
U.S. Army Corps of Engineers
St. Paul District
1135 U.S. Post Office & Customs House
St. Paul, Minnesota 55101-14799

RE: ROCHESTER FLOOD CONTROL PROJECT/STAGE 1B FDM RECREATION AND LANDSCAPE CONCERNS

Dear Colonel Briggs:

During 1986 the City has had a number of discussions and meetings with Corps of Engineers staff concerning the Feature Design Memorandum for Stage 1B of the South Fork Zumbro River Flood Control Project. In those discussions, City representatives have expressed a number of concerns regarding some design aspects of the Stage 1B Feature Design Memorandum plans.

These concerns primarily related to the extensive use of riprap material in Stage 1B, especially in the area along both banks of the Zumbro River adjacent to the Mayo Civic Center and on the east bank of the Zumbro River from Center Street to the Seventh Street N.E. bridge. The City believes that some further review and study of landscape or design alternatives in those areas is in order.

We would, therefore, request either that such study be conducted prior to completion of the Stage 1B FDM or that some assurance be provided by the Corps that the City's concerns regarding the landscape design aspects of the Stage 1B FDM can and will be studied, with the active involvement of the City, between the Stage 1B FDM and the Stage 1B Plans and Specifications stages.

The City would also wish to have active and early involvement in the preparation of the FDM plans for the subsequent stages of the project. The City would request an opportunity to work with the Corps staff or the A/E firm retained to prepare the FDM for the next stage, Stage 2. As joint partners in this project, cooperation and coordination in the earliest stages of plan preparation will facilitate timely implementation and construction of the project.

Sincerely,

Chuck Hazama
Mayor

File

1517-08
Rochester/Zumb

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
1135 U.S. POST OFFICE & CUSTOM HOUSE
ST. PAUL, MINNESOTA 55101-1479

August 18, 1986

REPLY TO ATTENTION OF
Engineering
Project Management

Mr. Gagnon/mm/5949

Mr. Gary F. Neumann
Assistant City Administrator
Room 214, City Hall
Rochester, Minnesota 55901

Dear Mr. Neumann:

I am responding to your July 14, 1986, letter concerning recreation and aesthetic treatments that are part of the Rochester flood control project. The enclosed memorandum for record summarizes our August 7, 1986, meeting and indicates our discussion and resolution of some of your concerns.

Also enclosed for your review and comment are two sets of drawings that constitute the 50-percent complete submittal from our A-E. We encourage you and your staff to review the drawings carefully and let us know about any problems or comments you have. We will proceed from this point to meet our schedule for submittal of the feature design memorandum in December 1986.

Sincerely,

Fischer 18 AUG 1986
Peter A. Fischer
Chief, Engineering Division

2 Enclosures
1. Memorandum
2. Drawings (2 cys)

MURASKI ED-M mm
GAGNON "
PLUMP "
POST ED
FISCHER "

DISPOSITION FORM

1517-53
Zumbro Lake

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL	SUBJECT
NCSED-M	Rochester Flood Control Project -- Meeting with City on Recreation and Aesthetic Treatments in Stage 1B

TO	FROM	DATE	CMT 1
Memo for Record	ED-M	14 August 1986 Gagnon/mm/5948	

1. The following people attended subject meeting on August 7, 1986, at the park and recreation building in Rochester:

Mr. Gary Neumann	Rochester City Administrator
Mr. Dennis Stotz	Rochester Park and Recreation
Mr. Al Toddie	Rochester Public Service
Mr. Don McGillivray	Rochester Public Service
Mr. Jim Gagnon	Corps of Engineers
Mr. Bruce Tamte	Corps of Engineers
Mr. Dave Tschida	Corps of Engineers
Mr. Greg Frankosky	Corps of Engineers

A copy of Mr. Neumann's July 14, 1986, letter is enclosed. Discussion at this meeting centered around the items in the letter referred to in the following paragraphs. After this meeting, Messrs. Neumann and Stotz and the Corps representatives walked through Stage 1B.

2. Items 1 and 2. Riprap vs. Concrete Walls and Landscaping.

Mr. Neumann stated that he had disussed the concerns of the Task Force with members of the City Council Flood Control Committee. The committee is concerned with the extent of riprap slopes. However, it appears willing to accept riprap if the main aesthetic treatment effort is placed in Stage IIA (downtown). It welcomes any suggestions for breaking up the riprap slopes, such as intermittent walls, steps, and planters. We stated that our A-E was nearly 50-percent complete with the functional design. We suggested that the city carefully review the plans and decide on its proposed plans for the stage. We agreed that a field tour, review of the plans, and a subsequent meeting should firm up the feature design memeorandum design.

3. Item 3. Concrete Wall Treatment.

We agreed that the aesthetic treatment of the concrete walls is desirable, particularly where the wall is open to public view. This item will be addressed as concrete walls and concrete caps on sheet-pile walls are designed.

4. Item 4. Trailway Fencing.

Mr. Tamte assured the city we would consider alternatives to chain link fence for the trail.

5. Item 5. Civic Center Stone Wall.

We looked at the wall on the walk; it did not to be appear in good shape. The A-E is verifying whether the wall can be used.

6. Item 6. Low-Flow Appearance.

NCSED-M 14 August 1986

SUBJECT: Rochester Flood Control Project - Meeting with City on Recreation and Aesthetic Treatments in Stage 1B

We reassured the city that the final water surface will extend bank-to-bank in the area of concern.

7. Item 7. Stages 1A - 1B Trailway Connection.

We explained that the A-E work order extends only to the North Broadway bridge and that he would not be required to provide the connection. We will use in-house layout to provide the connection in the feature design memorandum for Stage 1B and plans and specs for Stage 1A.

8. During the walk of Stage 1B, Mr. Neumann and I agreed that a tour should be provided for the Task Force and Flood Control Committee to view completed riprap projects. I suggested the Rushford and Winona projects would give the city a feel for riprap channel and slope protection on an older and a newer project. He said that he would arrange a tour.

1 Encl att.
July 14 letter

James L. Gagnon

JAMES L. GAGNON
Project Manager

City of **ROCHESTER**
Minnesota 55901

GARY H. NEUMANN
Assistant City Administrator
Room 214, City Hall
(507) 285-8082

July 14, 1986

Jim Gagnon
Corps of Engineers
1135 USPO
St. Paul, Minnesota 55101

RE: STAGE 1B FEATURE DESIGN MEMORANDUM

Dear Jim:

On 7/10/86, a meeting of the Rochester Riverfront Task Force was held. One topic of discussion was a continuation of the review of Corps preliminary Stage 1B plans. A number of questions and concerns were discussed as will be described below. In general, the Task Force viewed this area between the Silver Lake Dam and the 3rd Avenue S.E. bridge as an area which will have considerable usage and visibility following construction. This area, as well as the Stage II area between the 3rd Avenue S.E. bridge and the South Broadway bridge, may therefore justify consideration of a higher level of amenity treatment.

1) RipRap Channel Treatment or Concrete Walls

The plans contained in the September, 1982, Corps of Engineers Phase II General Design Memorandum showed rock riprap channel treatment commencing just north of the 7th Street N.E. bridge extending south to approximately the Chicago and Northwestern Railroad bridge. Vertical walls commenced at the C&N railroad bridge and extended southerly to the East Center Street bridge. Rock riprap channels again commence at the East Center Street bridge and continue past the Civic Center almost to the 2nd Avenue S.E. bridge where vertical walls again commence.

The only change in this design which has been mentioned by the Corps relates to the area on the east side of the river from the C&N railroad bridge to the East Center Street

bridge. The Corps has indicated that it may be difficult and expensive to construct a vertical wall in this area due to potential bedrock conditions. The Corps is, therefore, currently studying whether a riprap channel treatment on the east side could replace the vertical wall shown in the Phase II Memorandum in this area.

The Task Force expressed some concern regarding the potential appearance of riprap channel walls in this Stage 1B channel area. Some channelization plans from other communities which the Task Force has received from the Corps show concrete terraced walls (San Jose) or a low flow vertical wall with an additional vertical wall further back for the high flow channel. The Task Force recognized that such designs may be more expensive, but may also provide an improved aesthetic appearance and may increase the opportunities for landscape treatment in this stage. The Task Force requested that the Corps be contacted to determine whether such designs can be studied by the Corps to provide an alternative which can be considered by the community.

2) RipRap Channel Treatment Design/Landscape Treatment

In the event that a riprap channel treatment is implemented for this area, the Task Force suggested that some information be provided by the Corps on whether planter boxes or vegetation can be utilized to soften the appearance of the riprap channel face. Areas in which the elevation or face of the riprap channel is altered for underbridge trailways should also be investigated for potential landscape improvements.

3) Concrete Vertical Walls/Design Treatment

The Task Force emphasized that some aesthetic or vegetative treatment should be required for the face of any concrete vertical walls constructed in this stage. Some members of the Task Force had previously been involved in discussions with the Corps in the mid-1970's on this topic and were of the belief that the Corps was planning to incorporate such aesthetic treatments into the concrete wall design.

4) Trailway Fencing

It is the Task Force's understanding that fencing may be installed adjacent to the trailway. The Task Force believes that steel pipe or natural wood material fencing should be considered to enhance the aesthetic treatment of the project. Some fencing examples from other communities did indicate that alternatives to chain link fencing had been utilized in other Corps projects. Some examples of steel pipe fencing along the Zumbro River are currently in use in Rochester near 4th Street S.E. adjacent to Estabans and the Riverside properties.

5) Civic Center Area/Stone Wall

An existing stone wall near East Center Street on the east side of the Zumbro across from the Civic Center would provide a better appearance, in the Task Force's opinion, than the proposed riprap wall in this area. The Task Force requested that this existing stone wall remain if it is in sound condition and can feasibly be incorporated into the Corps channel design.

6) Low Flow Appearance

The Task Force was previously advised that the water surface of the river channel between the 2nd Avenue S.E. bridge and Silver Lake appears to extend across the entire channel width to a depth of 3-4 feet. They expressed a concern that the widened channel should not have a low flow area with an expanse of mud or river bottom extending to the riprap or channel wall face. This concern is created by the removal of the Nelson dam which currently creates the full river channel condition from the Nelson dam past the Civic Center to 2nd Avenue S.E. The Task Force wanted some confirmation that the channel will be full to a 3-4 foot depth from Silver Lake to the 2nd Avenue S.E. bridge.

7) Stage IA-Stage IB Trailway Connection

An additional concern mentioned by the Park Department staff is that the connection or link between the Stage IB and IA trailways be considered and studied by the A/E firm. The concern is that the IB study not simply be dead-ended at the North Broadway bridge but, at least, provide enough

information on the trailway connection to the Stage IA area to determine that the IB alignment is feasible.

After you have had an opportunity to review this information, I would appreciate an opportunity to discuss it with you. I would like to determine how or whether the Corps will have the A/E firm study and report back on these items. The intent of the Task Force has been to list reasonable alternatives for future study. The Task Force was well aware that the cost for some of these items may increase the project costs and the local share and that such items may, in the end result, be too costly to be included in the project. This does appear to be the time for this study so that future decisions can be made on complete information.

Sincerely,

Gary Neumann

Gary Neumann
Assistant City Administrator

GN/kas

cc: Stevan Kvenvold
Roger Plumb
Denny Stotz
John Harford